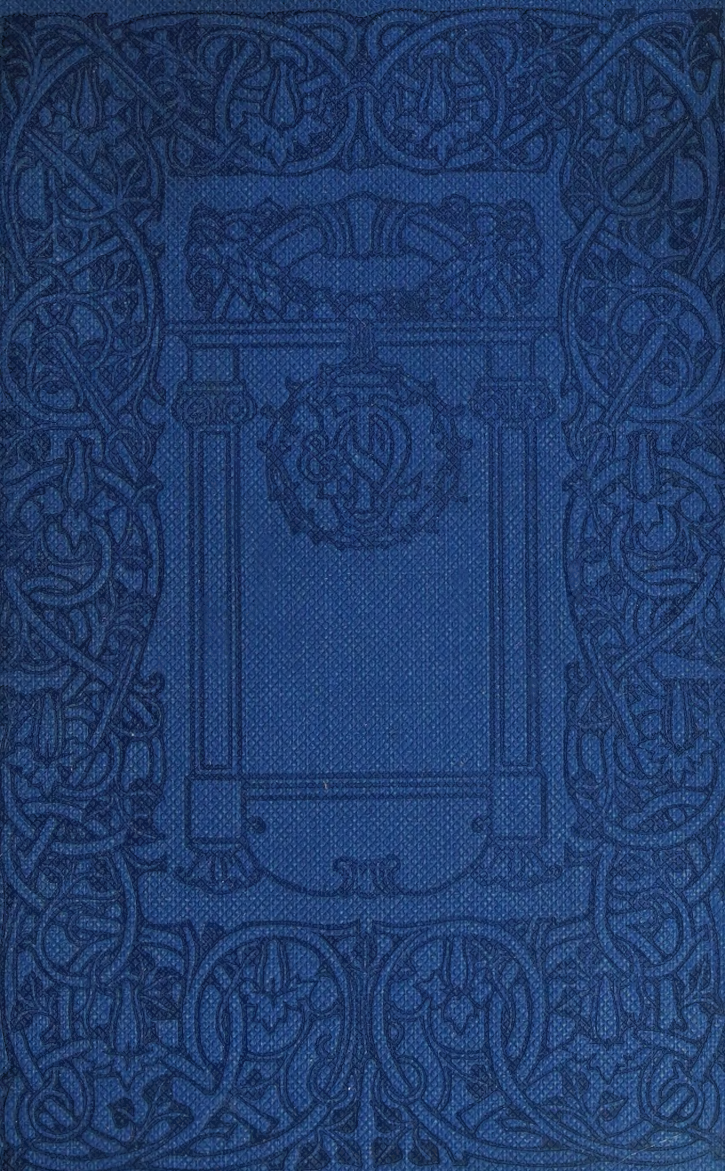

THE VOYAGE OF
THE 'DISCOVERY'

A. C. Ramsay

Oliver Villa
22/4/13.

UNIFORM WITH THIS VOLUME.

THE GREAT BOER WAR. *Arthur Conan Doyle.*
COLLECTIONS AND RECOLLECTIONS. *G. W. E. Russell.*
REMINISCENCES. *Sir Henry Hawkins.*
LIFE OF LORD RUSSELL OF KILLOWEN. *R. Barry O'Brien.*
FROM THE CAPE TO CAIRO. *E. S. Grogan.*
A BOOK ABOUT THE GARDEN. *Dean Hole.*
WITH KITCHENER TO KHARTUM. *G. W. Steevens.*
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PARIS TO NEW YORK BY LAND. *Harry de Win*
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LETTERS OF DR. JOHN BROWN.
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BY DESERT WAYS TO BAGHDAD. *Louisa Jebb.*
SOME OLD LOVE STORIES. *T. P. O'Connor.*
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PROBLEMS OF POVERTY. *Dr. Chalmers.*
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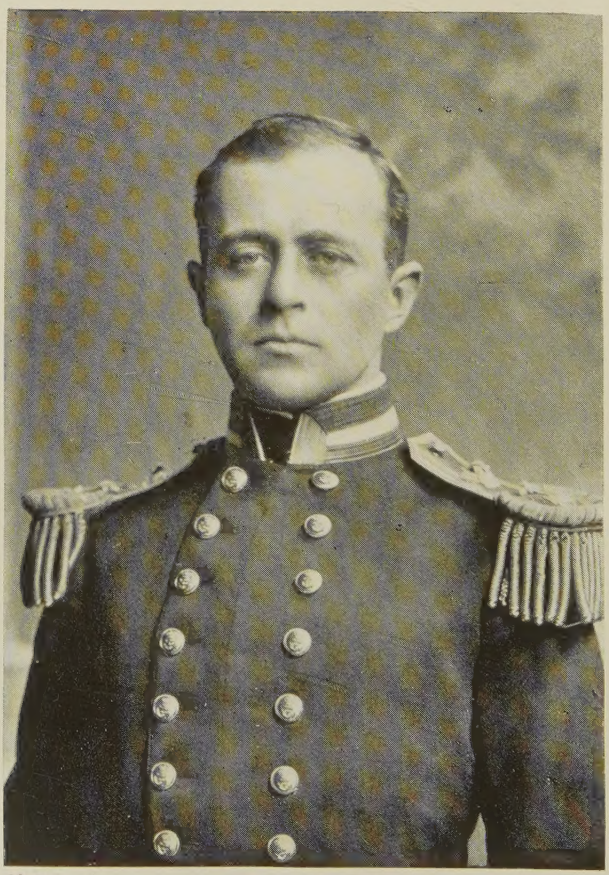
LIFE AND LETTERS OF LORD MACAULAY.—I. & II. *Sir George O. Trevelyan, Bart.*
WHAT I SAW IN RUSSIA. *Hon. Maurice Baring.*
WILD ENGLAND OF TO-DAY. *C. J. Cornish.*

Etc., etc.

Others to follow.



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CAPTAIN ROBERT F. SCOTT, C.V.O., R.N.

THE VOYAGE OF THE 'DISCOVERY'

BY

CAPTAIN ROBERT F. SCOTT
C.V.O., R.N.

IN TWO VOLUMES

VOL. I.

THOMAS NELSON & SONS
LONDON, EDINBURGH, DUBLIN
AND NEW YORK
(By arrangement with Messrs. Smith, Elder & Co.)

TO

SIR CLEMENTS MARKHAM, K.C.B., F.R.S.

THE FATHER OF THE EXPEDITION

AND ITS MOST CONSTANT FRIEND

PREFACE

STRANGE as it may seem, the greater part of this story had been enacted before I realised that it would devolve on me to narrate it in book form.

When first I saw vaguely this unwelcome task before me there was fresh in my mind not only the benefit which we had derived from studying the records of former Polar voyages, but the disappointment which we had sometimes suffered from the insufficient detail which they provided. It appeared to me in consequence that the first object in writing an account of a Polar voyage was the guidance of future voyagers; the first duty of the writer was to his successors.

I have done my best to keep this object in view, and I give this explanation because I am conscious that it has led me into descriptive detail which will probably be tiresome to the ordinary reader. As, however, such matter is more or less massed into certain portions of the book, I take comfort from reflecting that the interested reader will have no difficulty in avoiding such parts as he may consider tedious.

I have endeavoured to avoid the use of technicalities, but in all cases this has not been possible, as the English language is poor in words descriptive of conditions of ice and snow. I take the opportunity, therefore, of defining some technical words that I have used freely.

Névé—the packed snow of a snow-field, an accumulation of minute ice crystals. This word is, of course, well known to mountaineers.

Nunatak—an island of bare land in a snow-field. Where an ice-sheet overlies the land, the summits of hills thrust through the sheet present this appearance.

Sastrugus—an irregularity formed by the wind on a snow-plain. 'Snow-wave' is not completely descriptive, as the sastrugus has often a fantastic shape unlike the ordinary conception of a wave.

Ice-foot—properly applied to the low fringe of ice formed about Polar lands by the sea-spray. I have used the term much more widely, and perhaps improperly, in referring to the banks of ice of varying height which skirt many parts of the Antarctic shores, and which have no connection with sea-spray. Mr. Ferrar gives some description of these in his remarks on ice in Appendix I.

Beyond explaining these few words I make no apology for the style or absence of style of this book; I have tried to tell my tale as simply as possible, and I launch it with the confidence that my readers will be sufficiently indulgent to its faults in remembering the literary inexperience of its writer.

For me the compilation of these pages has been so weighty a matter that I must always feel the keenest gratitude to those who assisted me in the task. I cannot think that the manuscript would ever have been completed but for the advice and encouragement I received from its publisher, Mr. Reginald Smith, nor can I forget to thank Sir Clements Markham and other friends for hints and criticisms by which I profited, and Mr. Leonard Huxley for his judicious provision of the 'hooks and eyes' to many a random sentence. How much I owe to those of my comrades who are responsible for the originals of the illustrations, will be evident.

R. F. S.

August 28th, 1905.

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THE SHIP'S COMPANY.

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CHARLES W. R. ROYDS, Lieut. R.N.
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Civilian.

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Frank Plumley, stoker R.N.

R. F. SCOTT, *Captain.*

THE VOYAGE OF THE 'DISCOVERY'

CHAPTER I

HISTORICAL

Attention first drawn to Antarctic Region by Delineation of Map Makers—Earliest References to Climatic Conditions—Varthema—Vasco da Gama—Drake—Quiros—Tasman—Kerguelen—Cook—Bellingshausen—Weddell—Biscoe—Balleny—D'Urville—Wilkes—Ross—Later Expeditions—'Challenger' Expedition and Result—Inception of National Antarctic Expedition—Sir Clements Markham—Action of Societies—Mr. Longstaff—Decision to build new Ship—My own Appointment—Finance Committee—Naval Crew—Purchase of Stores.

> Till then they had deemed that the Austral earth
> With a long unbroken shore
> Ran on to the Pole Antarctic,
> For such was the old sea lore.—RENNELL RODD.

A BIBLIOGRAPHY of the Arctic Regions would occupy a large volume; that of the Antarctic Regions compiled by Dr. H. R. Mill in 1901 contained 878 references, and included all books, pamphlets, and maps even remotely touching the subject that had been published in any country. This great difference in the published matter relating to the two ends of our globe justly represented the relative knowledge concerning

them in 1901, to whatever extent the disproportion has been modified since that year.

The history of the Arctic Regions stretches back for many centuries, to the adventurous voyage of Oht-here, the friend of King Alfred, and to the exploits of the Norsemen in Greenland; the history of the Antarctic Regions commences at a much later period, and attention was drawn to them, not so much by the voyages of discoverers as by the persistent delineations of a great Southern continent by the map makers. The idea of this conjectural continent probably arose at a very early date, and when there was much excuse for such a view; but it was retained with extraordinary pertinacity throughout several centuries, being held long after the voyages of many navigators had disproved the existence of parts and thrown strong doubt on the accuracy of the whole conception.

Ortelius, in his '*Typus orbis terrarum*,' published in 1570, boldly draws the coast of '*Terra australis nondum cognita*' round the world and well to the north, even crossing the Tropic of Capricorn in two places. The editions of Mercator follow this delineation pretty exactly down to the one published by Hondius in Amsterdam in 1623, and although the famous map of the world prepared for Hakluyt in 1599 has the merit of omitting the Southern continent as unauthenticated, the fictitious coastline continued to appear in later maps and naturally attracted the attention of enterprising navigators.

There are three legends on the Southern continent of Ortelius's map: one is to the effect that it is named by some the Magellanic Region; the second tells us that the Portuguese called the part south of the Cape '*Psittacorum regio*' (region of parrots), because of the incredible number of these birds; and the third, opposite to Java, refers to Marco Polo and Varthema for statements

of very extensive land to the south. At this time a fanciful idea prevailed among cartographers that there must be a great mass of land to the south to balance the known land to the north.

The earliest references to the climatic conditions of the Antarctic Regions are perhaps to be found in the statement of Amerigo Vespucci; this famous person acted as pilot of a Portuguese expedition which, after surveying the coast of Brazil in 1501, is supposed to have sailed to the south and to have sighted the land of South Georgia, of which Vespucci remarks: 'A rocky coast without any port or inhabitants. I believe this was because the cold was so great that no one in the fleet could endure it.' Another curious indication of the same nature is to be found in the conversation which the Italian traveller Ludovico di Varthema, referred to by Ortelius, had with the Malay captain who took him to Java in 1506. The skipper knew how to steer by the compass and by a certain star of the Southern hemisphere as well as by the pole-star. He told Varthema of a region far beyond Java where the day only lasted for four hours, and said that it was colder than any other part of the world. Varthema concludes his account of the conversation by saying, 'We were pleased and satisfied'!

The manner in which the veil of mystery was first lifted from the Southern hemisphere was naturally enough by the extension of exploration along the coast-lines of the Northern land masses, but it was long before the facts thus ascertained ceased to be distorted by cartographers. The circumnavigation of the Cape by Vasco da Gama in 1497 did not extend sufficiently far south to upset calculations greatly, but when in 1520 Magellan discovered the strait which bears his name, Tierra del Fuego, to the south, was at once seized upon as an evident part of the *Terra australis*, and its coasts

were unhesitatingly joined to the main outline of that continent. And when Sir Francis Drake in 1577 'came finally to the uttermost part of the land towards the South Pole; the extreme cape or cliff lying nearly under 56° S., beyond which neither continent nor island was to be seen; indeed the Atlantic and the Pacific Oceans here unite in the free and unconfined open,' his discovery seems to have been completely misrepresented, and his accounts were garbled in such a manner as to have taken centuries to unravel.

How complete was the ignorance of Southern conditions at the commencement of the seventeenth century can be gathered from the voyage of Quiros. Pedro Fernandez de Quiros was a Portuguese pilot in the Spanish service; favoured by the Pope Clement VIII., he obtained an order from the King of Spain, Philip III., to prosecute a voyage to annex the South Polar continent and to convert its inhabitants to the true faith. He sailed from Callao in 1605 and steered to the W.S.W., but after proceeding a month on this course his heart failed him, and in latitude 26 S. he turned to the W.N.W. On this track he discovered the largest of the New Hebrides group, named it 'Australia del Espiritu Santo,' and, firmly believing it to be part of the Southern continent, solemnly annexed it, with the South Pole itself, to the crown of Spain!

Of the early voyages of the seventeenth century, that of the Dutchmen Schouten and Le Maire in 1616 went to establish Drake's discovery of the meeting of Atlantic and Pacific Oceans south of Cape Horn, and to curtail the extent of the Southern continent in this direction; but more important was the voyage of Tasman, who actually set forth in search of the continent, and in 1642, after crossing the Indian Ocean between the latitudes of 45 and 49 S., discovered Tasmania and the northern island of New Zealand. This was a heavy blow to the

theory of a great Southern continent, because it was in this region that its most northerly extension had been suggested by the early cartographers, and Tasman showed that it could not lie much beyond the 50th parallel either in the Indian Ocean or to the south of Australia, then known as New Holland. How slowly even important information of this sort must have travelled in those days is shown by the fact that in 1660, when Wells published his 'new set of maps,' he says: 'New Holland is esteemed to be part of the Southern unknown continent.'

The result of these voyages was to give a great impetus to others; especially it encouraged ships to venture to make the passage about Cape Horn, and this in turn led to a considerable increase of knowledge in this region. Voluntarily or involuntarily ships attained a comparatively high latitude, reaching the 62nd or 63rd parallel, and, for the first time encountering the great Southern icebergs, obtained some idea of the severity of the Southern Regions.

But the idea of a great and populous Southern continent, though weakened, was by no means dissipated, and the eighteenth century saw several expeditions despatched in search of it. Of these, some of the most important were the French ventures under Bouvet, Marion du Frezne, and De Kerguelen-Tremarec, which led to the discovery of Bouvet Island, the Crozets, and Kerguelen, and collected much further evidence to show the great extent of the Southern Seas.

During the latter half of the eighteenth century there came a marked change in the objects which were set before the Southern voyagers. Hitherto men seemed to have thought of little but the aggrandisement of themselves or their State by the discovery of some new America; but now for the first time we find an eagerness in exploration for its own sake. Science had made

rapid strides, and it was felt that its ends should be furthered by a completer knowledge of the distribution of land and water on our globe, and by an investigation of natural phenomena in its less-known regions. This new view of exploration was held most strongly in France and England, and both Marion and Kerguelen in their voyages in 1771–2 were accompanied by a staff of learned men whose sole object was to add to the scientific knowledge of the regions visited. Curiously enough, the last of these voyagers, starting as he did under these more favourable conditions for exploration, succeeded in retarding rather than in advancing the cause of geography, for he interpreted the island which bears his name as part of a larger land mass, and boldly concluded that the great Southern continent had at last been found.

But this error, with many another, was soon to be rectified, and the whole mythical conception of the Southern continent to be swept away once and for all, when the great English navigator James Cook made known the results of his famous voyages. To give even a summary of the far-reaching effects of these wonderful voyages is beyond the scope of this chapter, but it may be briefly noted how each bore on the Antarctic problem that is before us.

In his first voyage, in 1768, Cook circumnavigated New Zealand and laid down the eastern coast of New Holland, thus definitely cutting off these lands from any connection with the Southern Regions; this alone cleared up great misconceptions, but speculative geography continued to suggest that there was a continent further to the south, and finally Cook undertook to set the matter definitely at rest by a second voyage. This voyage is the most important incident in the history of Antarctic research, and may therefore be given in outline.

Cook sailed from Deptford in 1772 with two ships, the 'Resolution,' 462 tons, and the 'Adventure,' 336 tons. From the Cape he steered due south, and in spite of icebergs, fogs, and stormy weather, boldly pushed on to the 58th parallel, where he turned to the S.E. On January 17, 1773, *he succeeded in crossing the Antarctic Circle for the first time,* in longitude 38 E. Finding his progress blocked by ice, he turned again to the N.E., but not without giving us the impression that he must have been the first to see that icy barrier which appears to fringe the greater part of the Antarctic lands.

Passing to the south of Kerguelen, he showed the very limited dimensions of that island, and reached the 62nd parallel in longitude 95 E. Thence he continued more or less in the same high latitude to the 148th meridian, where he turned towards New Zealand. In November of the same year he again steered to the south, and reached the 60th parallel in 174 W.; constantly repulsed by the ice, he fought his way on east and south; in longitude 142 W. he crossed the Antarctic Circle a second time, but so arduous had been the labour of working the ship continuously among the ice that he was obliged to retreat to the north to give his crew some rest. It was not for long, however, for towards the end of January he was again on the Antarctic Circle in longitude 109 W. This time he was able to push on still further to the south, and it was not until he had reached latitude 71.10 S. in longitude 107 W. that he was forced to turn. What Cook actually saw in this advanced position is a matter of great interest; he describes a belt of pack with an unbroken sheet of ice beyond, which appeared to him to rise in level and in which he counted ninety-seven ice-hills. He does not definitely state that he saw ice-covered land, but many authorities have believed that his description could mean nothing else; with some experience of the de-

ceptive appearances of ice masses, however, I am inclined to think that the evidences are by no means sufficient to support this view.

After turning, Cook retreated to the north, and spent the winter amongst the Pacific Islands; in November he once more turned south and made his way towards Cape Horn between the parallels of 50 and 60 S., and thus for the first time traversed the Pacific in a high southern latitude. After doing much valuable surveying work in the region of Cape Horn and South Georgia, he again steered to the east, and now crossing the Atlantic in a high latitude, between 58 and 60 S., he finally returned to the Cape.

The importance of this voyage can scarcely be exaggerated; once and for all the idea of a populous fertile Southern continent was proved to be a myth, and it was clearly shown that whatever land might exist to the south it must be a region of desolation hidden beneath a mantle of ice and snow. The vast extent of the tempestuous Southern Seas was revealed, and the limits of the habitable globe were made known. Incidentally it may be remarked that Cook was the first to describe the peculiarities of the Antarctic icebergs and floe-ice.

One might pause here to consider the extent of human knowledge as regards the Antarctic Regions at the end of the eighteenth century after Cook's voyages, because it can be stated with brevity. The ocean was known to encircle the world completely about the 60th parallel; beyond this lay a region of icebergs and intense cold; attempts to penetrate this inhospitable region had seemed to show that in many places ships might force their way to the Antarctic Circle, but at about this latitude they were stopped by impenetrable obstacles; if land lay beyond this, it was, in Cook's words, as 'countries condemned to everlasting rigidity by nature, never to yield to the warmth of the sun, for whose wild

and desolate aspect I find no words.' Generally speaking, therefore, people had come to the conclusion that if land existed beyond the 60th parallel, it was not of much account.

After the return of Cook no important expedition was sent to the Southern Seas until 1819, when Bellingshausen sailed from Kronstadt with two well-equipped vessels. The object of this voyage was to emulate the achievement of Cook in circumnavigating the globe in a high southern latitude, and well was this mission fulfilled. With wonderful pertinacity the intrepid Bellingshausen again and again steered his ships to the south, and he succeeded no fewer than six times in crossing the Antarctic Circle. Although he did not reach such a high latitude as his predecessor, on the whole his course lay to the southward, and he still further narrowed the limits of the southern land which had been so greatly reduced by Cook. Further, Bellingshausen was the first definitely to discover land within the Antarctic Circle. In the longitude of 90 W. he saw a small island which he named Peter I. Island, whilst farther to the eastward he sighted in the distance a more extensive coast which he called Alexander I. Land. Unfortunately, little is known of Bellingshausen's voyage, as the narrative was never translated into English from the original Russian.

As regards the Southern Seas the early years of the nineteenth century were memorable for the development of the great whaling and sealing industries which flourished for half a century, and passed away only with the practical extermination of the animals on which they depended. It is strange to think that regions which before Cook's famous voyage were utterly unknown to man should have so speedily become the scenes of great activity, but no sooner was the existence of whales and seals in the Southern Seas reported than hundreds

of English and American adventurers crowded in pursuit of them, and as late as 1840 it was reported that there were no fewer than 400 vessels occupied in this manner.

Amongst the owners of these vessels were men of broad public spirit, and the captains who commanded them included not a few of larger intelligence or more liberal education, who were keenly interested in the prosecution of geographical discovery. Conspicuous amongst the former were the famous firm of Enderby, who instructed the commanders of their ships never to neglect an opportunity for discovery and exploration, and who more than once sent forth an expedition largely for that purpose; whilst amongst the more enterprising commanders may be named Weddell, Biscoe, and Balleny. The result of this enlightenment was to add considerably to our knowledge of the Southern Regions.

The most important voyage made in these circumstances was that of James Weddell. After doing some excellent surveying work among the Southern islands in 1823, Weddell, in his small brig the 'Jane,' and accompanied by the cutter 'Beaufoy,' crossed the Antarctic Circle in longitude 32 W., and, passing innumerable bergs, found himself in an open sea, through which he sailed, and eventually reached a latitude of 74.15 S., more than three degrees to the south of Cook's farthest point. In this position, and when he could see nothing to the south but the clear sea horizon, he was forced to turn on account of the state of his crew and his provisions. For nearly twenty years this remained the most southerly point reached, and the extraordinarily open condition of the sea as reported by Weddell has rendered the region to this day one of the most fascinating to which prospective explorers can turn their thoughts.

Biscoe was one of Enderby's officers, and had been a mate in the Royal Navy. Like Weddell's, his voyage

was made in a small brig, the 'Tula,' accompanied by a tiny cutter, the 'Lively.' He crossed the Antarctic Circle in longitude 2 E., and succeeded in running to the eastward on an exceedingly high latitude. On February 25, 1831, he discovered an ice-barrier which he likened in height and appearance to the North Foreland. He added: 'It then ran away to the southward with a gradual ascent, with a perfectly smooth surface, and I could trace it in extent to at least 30 or 40 miles from the foretop with a good telescope.' His ship at this time was in latitude 66.2 S., longitude 43 W., but apparently he again saw this icy barrier farther to the eastward and observed several indications which denoted the proximity of land. It was this coast to which he gave the name of Enderby Land. Biscoe wintered in New Zealand, and in the following season he sailed to the south again, and continuing his circumnavigation of the earth in a high latitude, discovered Graham Land, which, although connected with lands already known to the sealing community, gave a considerable extension to them.

Another voyage of great importance was made by John Balleny, also under the auspices of the enterprising firm of Enderby. Balleny started his voyage of discovery from New Zealand, in 1839, sailing in a schooner, the 'Eliza Scott,' in company with the cutter 'Sabrina.' He crossed the Antarctic Circle in longitude 177 E., but, unlike former voyagers, directed his course to the west instead of the east. On February 9 he discovered the group of islands which bear his name, and which I shall describe more fully in the course of my narrative. From this region Balleny was obliged to steer to the N.W., but later he was able to turn to the south again, and on March 2, when in latitude 64.58 S., longitude 121 E., he made the following laconic entry in his log: 'Saw land to the southward, the vessel surrounded by drift-

ice.' On the following day he noted 'every appearance of land,' and other entries tell of the large number of birds seen. On such slender evidence rests Sabrina Land, and yet after personally demonstrating the accuracy of Balleny's observations with reference to his islands, I should be sorry to undertake to sail over the spot where he 'saw land to the southward.' Balleny was evidently a man of few words, but of his ability as a navigator there can be no doubt.

This ends a brief retrospect of the discoveries made in connection with the whaling and sealing industries of the south, and shows that it is entirely honourable to the commercial enterprise of our country; for to the disinterested exertions of Mr. Charles Enderby and to the zeal of his officers was due the discovery of Graham Land, Enderby Land, Sabrina Land, Kemp Land, and the Balleny Islands, whilst with an English sealer, Weddell, rested the honour of having achieved the highest southern latitude.

The necessarily bold outline of fact which it is alone possible to give in these pages can convey no idea of the extraordinary hardships and difficulties successfully overcome by these men. In the smallest and craziest ships they plunged boldly into stormy ice-strewn seas; again and again they narrowly missed disaster; their vessels were wracked and strained and leaked badly, their crews were worn out with unceasing toil and decimated by scurvy. Yet in spite of inconceivable discomforts they struggled on, and it does not appear that any one of them ever turned his course until he was driven to do so by hard necessity. One cannot read the simple, unaffected narratives of these voyages without being assured of their veracity, and without being struck with the wonderful pertinacity and courage which they display.

In the light of subsequent events, it is convenient

to pause again at the close of Balleny's voyage to consider the further extent of Antarctic discovery. It must now have appeared to men that, after all, the South Polar area was occupied by land, and that the coast of this land clung very persistently to the Antarctic Circle. South of the Pacific, Cook and Bellingshausen had shown a dip towards the Pole, and south of the Atlantic Weddell had indicated another deep bay; but south of the Indian Ocean and of Australia it must have seemed highly probable that the coastline followed the Circle with little divergence. It can well be imagined, therefore, that explorers who were about to sail to the south in this direction must have been strongly disposed to expect land in that latitude.

At about this time there sprang up a new motive to encourage Polar exploration, in the shape of terrestrial magnetism. The development of this science had gradually converted it into a subject of great interest, its practical importance in connection with the navigation of ships was now fully realised, and it was known that no complete study could be made of its phenomena without extensive observations in the Polar Regions. Amongst the scientific men who devoted their energies to achieve a more general recognition of these facts were Humboldt and Sir Edward Sabine, and as a result of their labours in 1838 the British Association petitioned the Government to send a scientific expedition to the Antarctic Regions. The Government responded nobly to this petition, and organised an undertaking which was destined to achieve the most brilliant results, and to open up the Antarctic Regions in a manner which must have been wholly unexpected by its promoters.

But whilst Captain James Ross, the commander of this expedition, was diligently and carefully preparing and equipping his ships for this great venture, two other expeditions of importance had been despatched by other

countries. One of these had left the shores of France in 1837. It consisted of two ships, 'L'Astrolabe' and 'La Zélée,' under the command of Dumont D'Urville, an experienced navigator. D'Urville first descended on the Antarctic area in the region of Graham Land, with the intent to follow Weddell's course and reach a higher latitude; but in this he was frustrated by the pack-ice, and after making some minor discoveries in the neighbourhood of Louis-Philippe Land and Joinville Island he returned to pursue his investigations in milder climates. In the end of 1839 D'Urville was at Hobart Town, Tasmania, where for the moment we will leave him and follow the fortunes of the other and more imposing expedition, consisting of five vessels, which left Chesapeake Bay in 1837 under the command of Commodore Wilkes.

In relating the history of the voyages of Wilkes and D'Urville I touch only on those parts which have a relation to the Antarctic Regions, though it must be understood that both these expeditions pursued scientific investigations in other parts of the world.

On reaching the Southern waters Wilkes divided his forces, and whilst he turned his attention to minuter surveying work, he sent the 'Peacock' and 'Flying Fish' south-west towards Graham Land and Alexander Land. These vessels, after much struggling with the ice, reached the vicinity of Peter I. Island, but failed to attain a higher latitude than Bellingshausen or Cook had previously done in this region. The close of the season obliged them to retreat and rejoin the squadron without the achievement of any important result.

Towards the close of 1839 Wilkes, like D'Urville, had found shelter in Australian waters. By this time news of the prospective British expedition had been spread abroad, and it was known that, fully equipped for magnetic work, it proposed to sail directly for the position assigned to the magnetic pole by the calculations of the

great German magnetician Gauss; this position was approximately in latitude 76 S., longitude 146 E. It was known also that Ross could not be in a position to attempt to reach it until the following year. How far Wilkes and D'Urville were guided by this information in their future actions it is impossible to say; that they must have received it is certain, and, considering that neither expedition was completely equipped for magnetic work, the fact that both immediately set sail in the direction of the magnetic pole must be regarded at least as showing questionable taste on the part of the commanders.

D'Urville left Tasmania early in January 1840, and, after a comparatively easy passage, on January 19, when in latitude 66 S., longitude 140 E., sighted land to the south. At first he seems to have seen nothing but the long ice-barrier so typical of Antarctic coasts, but later he found beneath the icy wall eight or ten small islets on which his people were able to land and to collect specimens of rock. He named this coast Adélie Land, and, continuing his explorations to the west, again sighted the ice-barrier somewhat more to the north, and named it Côte Clarie. Satisfied with the result of his voyage, D'Urville then turned to the north. Although it is to be deplored that he did not take full advantage of the season to continue his explorations, the discovery of Adélie Land was an extremely important matter, and possesses a definition which is sadly lacking in other reports.

Wilkes with his five ships sailed from Sydney at the end of December 1839. His ships took various tracks, but he himself in the 'Vincennes' reached latitude 66 S., longitude 158 E., on January 16, and at this point he claimed to have first seen land to the south. Hence he cruised to the westward, approximately on the latitude of the Antarctic Circle, with a comparatively open sea to the north and masses of pack-ice to the south; and beyond the latter he again and again claimed the dis-

covery of high mountainous land. He passed close to Adélie Land and Côte Clarie only a few days after their first discovery by D'Urville, and, continuing his course, alleged the discovery of further extensive lands to the westward.

On his return to civilisation Wilkes claimed a vast discovery. The courses of his ships had practically traversed an arc of the Antarctic Circle of no less than 70°, and, although he did not assert that he had seen land continuously south of this arc, he reported its existence at such frequent intervals as to leave little doubt that it was continuous.

At a later date a great controversy arose as to the accuracy of Wilkes's observations, and resulted in much discredit being thrown on work which in many respects was important. Whilst there can be no possible object in attempting to revive such a controversy, it is evident that the true geographical conditions should be known, and therefore I make bold to give my opinion of the matter. In the course of this narrative I shall show that the mountainous lands reported by Wilkes to the eastward of Adélie Land do not exist, and it must be recognised that those to the west may be equally unsubstantial, but it is not clear that Wilkes wilfully perverted the truth; only those who have been to these regions can realise how constantly a false appearance of land is produced, and no position could be more favourable to such an illusion than that in which this expedition was placed when it skirted the edge of a thick pack containing innumerable icebergs. It must be supposed also, for reasons which I have given, that Wilkes, in common with other explorers, expected to find land about the Antarctic Circle, and when after his return he learned of D'Urville's discoveries, the position of Adélie Land would naturally have tended to dispel any doubt which he may have had as to what he or his people had seen.

Wilkes's ships were ill adapted for battling with the ice, and, apart from their discoveries, the fact that they continued so long in high latitudes reflects great credit on their navigation. Had he been more circumspect in his reports of land, all would have agreed that his voyage was a fine performance.

Whilst Wilkes and D'Urville were pursuing their explorations, Ross had sailed from England. James Ross had taken part in the Northern voyages of Parry and of his uncle John Ross; in the course of these he had spent no fewer than eight winters in the Arctic regions, and he therefore brought an unrivalled experience to the task of fitting out his Southern command.

For the purposes of the expedition, two old bomb vessels were chosen, the 'Erebus,' 370 tons, and the 'Terror,' 340 tons; though slow sailers, these vessels had the advantage of great structural strength, and when Ross had further fortified their bows he possessed two ships capable of navigating amongst the pack-ice, the first of such that had ever sailed for the Southern Regions. Towards the end of the year 1840, Ross arrived in Tasmania to learn that others had already explored the route which he proposed to take. Whatever his feelings may have been at the time, the incident proved exceedingly fortunate, for it was this alone which decided him to proceed south on a more easterly meridian, it being inconsistent with the traditions of British exploration to follow in the footsteps of other nations.

Sailing from Hobart in November, Ross reached the Antarctic Circle on New Year's Day in longitude 171 E., and at the same time found himself opposed by heavy masses of pack-ice. Here was the critical point at which the course taken by the expedition differed from that of its predecessors. Up to this time such an obstacle would have been deemed insuperable, and the older navigators would have sailed their light ships along its edge; Ross, with his

heavy ships, plunged directly into it and continued to buffet his way to the south. Making all allowance for the fortified condition of the ships, it was a bold stroke, and it met with the most ample reward. After pushing onward for five days through the closely packed floes, the vessels burst forth to the south into an open sea. Remembering the main object of his journey, Ross steered to the west towards the magnetic pole, and on January 8, 1841, discovered the glorious mountainous country of Victoria Land.

Ross's discoveries are so closely connected with my narrative, that it is unnecessary to refer to them in detail here. Twice he visited this great open sea, and the results of these extraordinarily interesting voyages may be summed up as follows: The high mountain ranges and the coastline of Victoria Land were laid down with comparative accuracy from Cape North in latitude 71 to Wood Bay in latitude 74, and their extension was indicated less definitely to McMurdo Bay in latitude 77½. In the same latitude, but slightly to the eastward, the lofty volcanoes of Erebus and Terror were discovered, and the former was found to be active. Stretching away to the eastward for 400 miles beyond these, Ross observed that great wall of ice which he named the Great Barrier. At the eastern end of this wall he achieved his highest latitude, 78.11 S., an advance of nearly four degrees on his predecessor Weddell. Ross was not able to disembark on this great mass of land which he had discovered, but managed to reach the shore of some off-lying islands which he named the Possession Islands.

There are many reasons why Ross's wonderful voyage should not have attracted the wide popular interest which it deserved, but when the extent of our knowledge before and after it is considered, all must concede that it deserves to rank among the most brilliant and famous that have been made. After all the experiences and adven-

tures in the Southern Seas which I have briefly described, few things could have looked more hopeless than an attack upon that great ice-bound region which lay within the Antarctic Circle; yet out of this desolate prospect Ross wrested an open sea, a vast mountain region, a smoking volcano, and a hundred problems of great interest to the geographer; in this unique region he carried out scientific research in every possible department, and by unremitted labour succeeded in collecting material which until quite lately has constituted almost the exclusive source of our knowledge of magnetic conditions in the higher southern latitudes. It might be said that it was James Cook who defined the Antarctic Region, and James Ross who discovered it.

This great expedition is brought curiously close to our own time when it is remembered that of those who took part in it there is yet one survivor. The young assistant surgeon of the 'Erebus' has become the renowned botanist and traveller Sir Joseph Hooker, and has lived not only to take a share in sending forth a second expedition to the same region, but to welcome it back to our shores nearly sixty years after his own return from the far south.

The 'Erebus' and 'Terror' reached the shores of England in September 1843, and for fifty years the map of the Antarctic remained practically unaltered, though during this period some important light was shed on the general conditions of the region, and the advance of science caused a gradual awakening of interest in it. The results of the few voyages to the Antarctic area during this long period, or indeed down to the close of the nineteenth century, may be summed up in a very few words.

Tempted by Sir James Ross's report of the large number of whales seen during his voyage, in 1892 a number of Scotch whalers set sail for the south, and touching the Antarctic lands in the neighbourhood of Joinville Island, threw some further light on that region; but as they

found no sign of the whales which they sought, the voyage was commercially a failure, and the vessels soon turned to the north again. In the following year, however, Captain Larsen, of the whaler 'Jason,' bent on much the same errand, managed to sail down the east coast of Graham Land, and to reach a latitude of 68.10 S. in longitude 60 W. This voyage has been very little noticed, though from a geographical point of view it is of great importance, as with Biscoe's discovery to the west, it showed the attenuated form which Graham Land possesses, at any rate until it is well south of the Antarctic Circle. Looking over the whole Antarctic area, I can scarcely see a place where geographical discovery is more urgently needed than in the extension of this bold effort of Larsen's.

Whilst Larsen pursued his investigations on the east coast of Graham Land, his compatriot Evenson, in the 'Hertha,' descended on the west side, and reached the high latitude of 69.10 S. in longitude 76 W. He sighted Alexander Land, but unfortunately does not appear to have extended its coasts, though there can be little doubt that it is connected with Graham Land.

A similar object, the hope of discovering a whale fishery, induced the veteran shipowner, Svend Foyn, of Tonsberg, to send one of his ships, the 'Antarctic,' to the Ross Sea area. This resulted in the first landing on Victoria Land, which was made by her captain, Christiansen, at Cape Adare, in 1894. Three years later Sir George Newnes sent an expedition to this spot, under Mr. Borchgrevink; the party landed safely, and spent a winter in a hut which will be introduced to the reader in the course of my narrative. Unfortunately this party did not travel far from its base, and so was unable to throw any light on the geographical conditions of the interior; but its scientific observations were of importance, and its geological collection especially interesting. Before leaving the south

Mr. Borchgrevink landed from his vessel, the 'Southern Cross,' towards the eastern end of Ross's Great Ice Barrier, and thus reached a higher latitude, by a few miles, than that achieved by the great explorer.

Whilst Sir George Newnes's expedition was wintering at Cape Adare, another band of explorers was living beyond the Antarctic Circle in a widely different region. The energies of M. de Gerlache had succeeded in equipping a small vessel, the 'Belgica,' for a Polar voyage, and this ship, passing down the west coast of Graham Land, through an unexplored channel, had become beset in the ice to the south-west of Alexander Land. Here, the first vessel to spend a winter beyond the Antarctic Circle, she drifted to and fro throughout a long imprisonment. Reaching at one time a latitude of 71.30, she was gradually carried to the westward, and at length freed near the farthest point reached by Cook in 1773. Equipped with modern apparatus and ideas, this expedition, if it did not add greatly to geographical knowledge, contributed much by its investigations in other scientific departments to the general cause of Antarctic discovery.

But by far the most important event in the history of Antarctic research, after the great voyage of Ross and before the close of the nineteenth century, remains yet to be described. This was the crossing of the Antarctic Circle by the famous 'Challenger' Expedition in 1874.

The 'Challenger,' under Sir George Nares, stood to the south on the meridian of 80 E., and after crossing the Circle turned to the north-east, and later to the east, remaining altogether some three weeks in the region of icebergs. During this time she pursued her customary employment of sounding and dredging in the depths of the ocean, and here, as elsewhere, this resulted in a rich harvest of fresh information. Amongst the specimens thus secured were numerous rocks of continental origin; there could be no doubt that these had been borne by ice from

some southern land, and therefore they showed that continental land must exist within the Antarctic Circle almost as conclusively as if the land itself had been seen.

But the importance of the 'Challenger' expedition as regards the Antarctic Regions lay not so much in the discoveries made as in the fact that they drew the attention of scientific men to the interest of the problems which yet remained to be solved in that area. From the return of this famous expedition and the publication of its results dates that revival of interest in the Far South which, fostered by a few eminent men, continued to spread and culminated in the despatch of the various e peditions which co-operated with the 'Discovery.'

This desire for further Antarctic research arose principally in Germany and England, but in both countries it was equally slow in arriving at a practical result. In Germany the repeated and energetic representations of the great magnetician Georg Neumayer gradually bore fruit, and resulted eventually in the despatch of our German colleagues under Professor von Drygalski in his good ship the 'Gauss.'

In England, whilst there were many Arctic explorers and others who were keenly interested in the subject, it was the written appeals of Sir John Murray that first secured for it a wider appreciation. Soon after the completion of his labours on that monumental work the 'Challenger' publication, Sir John Murray exerted his great abilities to stimulate a fresh interest in the Southern Regions; in 1886 he published an important treatise in the 'Scottish Geographical Journal,' which led to the despatch of the Dundee whalers to which I have alluded; this in turn tended to direct further attention to Southern exploration, and in 1893 Sir John read a second paper to the London Geographical Society which still more clearly and ably advocated the cause.

Meanwhile other events had occurred which, although

unproductive, were significant of the tendency of public thought. In 1885 an Antarctic Committee was appointed by the British Association, which two years later made a strong report in favour of further exploration. In 1887 the Victorian Government, through its agent Sir Graham Barry, offered to join the Home Government in sending out an expedition, but this scheme likewise fell through.

The actual birth of the 'Discovery' Expedition may be dated from July 1893, when Sir Clements Markham resolved that an expedition should be sent. The extraordinary strength and pertinacity of Sir Clements' character were already well known to his intimates, and they at least must have known that this resolve was momentous and signified that by hook or by crook an expedition would go. In virtue of his position as President of one of the greatest and richest societies in the world, Sir Clements was favourably placed for carrying out his determination, but few could deny that in the years of struggle and difficulty which followed, however ably and generously he was supported by his colleagues and others, it was mainly through his own unique, unconquerable personality that the expedition became a living fact.

As a result of the discussion on Sir John Murray's paper in November 1893, it was suggested that the Government should be approached with a view to sending out an expedition consisting of two ships. This proposal was supported by many eminent men of science, including the late Duke of Argyll, Sir Joseph Hooker, and the late Sir William Flower, and by such naval officers as Admirals McClintock, Vesey Hamilton, Hoskins, Colomb, Markham, and Lord Charles Beresford. It was on this occasion that the Duke of Argyll remarked on the incongruity of the fact that we knew more about the planet Mars than about a large area of our own globe.

The Council of the Royal Geographical Society therefore appointed a special Antarctic Committee. In a lengthy

report the Committee enumerated the objects to be gained by such an expedition, and concluded with the following words: 'Apart from the valuable scientific results of an Antarctic expedition, great importance must be attached to the excellent effect that all such undertakings, in which our country has been prominent, have invariably had on the Navy by maintaining the spirit of enterprise.'

To the appeal which followed this report in 1896 the Government opposed the existing state of public affairs, which made it inconvenient for the Navy to undertake such a task as was proposed; but in a later letter the Lords Commissioners of the Admiralty expressed their sympathy with the objects desired, and signified their willingness to assist any expedition that might be despatched.

Failing Government assistance, in May 1897, it was resolved by the Council of the Geographical Society that every effort should be made to start an expedition on a proper scale under its own auspices, but it was soon seen that this was a task of such magnitude that the assistance of all who were interested in the scheme would be required.

During the early months of 1898 the Royal Society was invited and agreed to co-operate; henceforth the undertaking was to be considered as under the auspices of two great Societies instead of one, and was demonstrably supported by the whole scientific opinion of the country. An important report by a sub-committee of the Royal Society clearly detailed the scientific objects which were to be sought, and laid particular stress on the extreme value of the magnetic work. Meanwhile Sir Clements Markham commenced and continued his indefatigable efforts to raise the necessary funds; the Geographical Society headed the subscription list with 5,000*l.*, and circulars were issued to the public.

In March 1899 this appeal met with a noble response, when Mr. Llewellyn Longstaff came forward with a muni-

ficent donation of 25,000*l.* When the 'Discovery' eventually sailed it was to act on a concerted plan between expeditions of various nationalities; it is quite certain that Britain would not have been represented in this exploring effort had it not been for Mr. Longstaff's public-spirited and patriotic gift. But whilst our countrymen complacently reflect that the British tradition for exploration has been maintained, they appear entirely to have forgotten the man who made it possible.

The position of the promoters of the enterprise was now greatly strengthened, and was made yet stronger when His Majesty the King, then Prince of Wales, graciously consented to become its patron, and the Duke of York vice-patron. Later in the year it was decided to make a further appeal to the Government; a deputation consisting of some of the most eminent men in both Societies waited on Mr. Balfour and restated the objects of the enterprise. Mr. Balfour expressed strong sympathy with the objects and a lively interest in the undertaking, and it was entirely owing to his generous attitude that the Government eventually yielded and agreed to contribute 45,000*l.*, provided an equal sum could be raised by private subscriptions.

Again Sir Clements Markham issued appeals for money, and gradually the private fund crept up. After Mr. Longstaff, amongst the largest and most generous contributors were Sir Alfred Harmsworth with 5,000*l.*, the Misses Dawson Lambton with 1,500*l.*, the Royal Society with 1,000*l.*, and the Government of Queensland, Australia, with 1,000*l.*; many others were equally generous in accordance with their means, and with a further sum of 3,000*l.* from the Geographical Society the private subscriptions were raised to 47,000*l.*, the Government grant was secured, and the whole available fund was carried to the adequate total of 92,000*l.* Financially all was now comparatively plain sailing.

As soon as Mr. Longstaff's gift had placed the expedition within the bounds of practical politics, the question of the vessel in which its members were to sail came under consideration, and the appointment of a special Ship Committee, consisting of several distinguished Admirals and Arctic explorers, was followed by the decision to build a new ship for the purpose.

Mr. W. E. Smith, C.B., Chief Naval Constructor, was invited and consented to prepare the plans and supervise the construction of this new vessel, and the Committee, in consultation with Mr. Smith, accepted the tender of the Dundee Shipbuilding Company to build her. In March 1900 the keel was laid in the Company's yard.

In the summer of this year the position of the National Antarctic Expedition, as it was now called, was briefly as follows: The money had been subscribed for the venture, the control of which was vested in the hands of a body named the Joint Committee, containing sixteen members appointed by each of the two Societies. The names which figured on the list of this Committee were those of gentlemen eminent in many branches of science, and of distinguished Admirals and explorers—in fact, of all those who were best able to give advice concerning the multifarious details of a scientific exploring expedition. As, however, this body, as a whole, was obviously too large to deal with matters of detail, it had appointed nine sub-committees; these were for the purpose of considering the various branches of science which were to be investigated, to supervise the construction of the ship, &c.; whilst one, the Executive Committee, was to act for and report to the larger body.

Such was the position of affairs when I received my appointment to command the expedition on June 10, 1900, and therefore, in making my bow to the public, I will digress slightly to show how this had come about. I may as well confess at once that I had no predilection

for Polar exploration, and that my story is exceedingly tame, but such as it is it shows how curiously the course of one's life may be turned. I suppose the tale really starts in 1887, when Sir Clements Markham, then the guest of his cousin, the Commodore of the Training Squadron, made himself the personal friend of every midshipman in the four ships which comprised it, and when I became one of those midshipmen and first made his acquaintance. But there is a long interregnum—until 1899, in fact; in that year I was serving as first lieutenant of the 'Majestic,' then flagship to the Channel Squadron. Early in June I was spending my short leave in London, and chancing one day to walk down the Buckingham Palace Road, I espied Sir Clements on the opposite pavement, and naturally crossed, and as naturally turned and accompanied him to his house. That afternoon I learned for the first time that there was such a thing as a prospective Antarctic expedition; two days later I wrote applying to command it, and a year after that I was officially appointed. On June 30, 1900, I was promoted to the rank of commander, and a month later my duties in the 'Majestic' lapsed, and I was free to undertake the work of the expedition. The year which followed was in many respects the busiest I have ever spent, and in view of the novelty and importance of the work this cannot be considered surprising; but, great as my difficulties were, I have to acknowledge that they would have been much greater had it not been for the numerous acts of kindness and the invariable courtesy which I received from the many persons who were directly or indirectly connected with the expedition.

The first month after my release from the Navy I spent in endeavouring to collect the threads of what was going forward, and in gaining some further instruction in magnetism, which was to form so important a part

of our undertaking; but early in October I met Sir Clements Markham in Norway, and gathered a great many practical suggestions from Dr. Nansen, to which I shall refer later; from Norway I went to Berlin to meet the leader of the German expedition, Professor von Drygalski, and here, again, I met with the greatest kindness and consideration. The German expedition was to sail from Europe at the same time as our own, but its preparations were far more advanced. In Berlin I found the work of equipment in full swing; provisions and stores had already been ordered, clothing had been tried, special instruments were being prepared, the staff of the expedition had been appointed and was already at work, and the 'Gauss' was well on towards completion. I was forced to realise that this was all in marked contrast with the state of things in England, and I hastened home in considerable alarm.

I found, as I had expected, that all the arrangements which were being so busily pushed forward in Germany were practically at a standstill in England; many of them, in fact, had not yet been considered. The construction of the ship was the only task which showed steady progress, and here there were many interruptions from the want of someone who could give immediate decisions on points of detail. It was clear that no time must be wasted if the lost ground was to be regained.

I have already outlined the machinery by which the expedition was now being guided. In spite of its individual efficiency it was necessarily ponderous; the members of the various committees and sub-committees were busy men; each was deeply engaged in his own work; many lived out of London, and all found it impossible to meet frequently and consistently. It was evident that the prompt and vigorous action which was necessary could not be expected from such bodies, and that in some manner I must obtain the power to act on their

behalf. But here arose a considerable difficulty: out of the thirty-two members who constituted the Joint Committee, I was personally known to only four or five; the responsibility vested in them was a large one, and it was not to be supposed that they would immediately place it in my hands without the showing of a strong case and reasonable guarantees. In this dilemma I have to acknowledge most gratefully the advice and assistance of Sir Arthur Rücker, then Secretary of the Royal Society, who, seeing my case, clearly pointed out the difficulties and offered to support me, provided I could produce a reasonable scheme by which they could be overcome.

On November 4 the Joint Committee met to consider such a scheme, and after some discussion passed it.

This resolution was of great importance; it left me practically with a free hand to push on the work in every department under a given estimate of expenditure in each, whilst to safeguard the interests of the Societies it provided that this expenditure should be supervised by a Finance Committee, which should control the business arrangements and sign the necessary cheques.

This plan has worked successfully down to the present time; that it has done so is mainly due to the generous manner in which the members of the Finance Committee have given their services to the business of the expedition, and to the complete accord with which they have worked together. It would be impossible to exaggerate the importance of the vast amount of business transacted by this Committee, and certainly no history of our expedition would be complete without a due acknowledgment of the individual and collective services of its members.

It was originally arranged that it should consist of the Presidents and Treasurers of the two Societies, but the President of the Royal Society desired that his place

should be taken by an official from the Treasury, and the constitution eventually became: Sir Clements Markham (Chairman); Mr. A. B. Kempe, K.C., Treasurer of the Royal Society; Mr. Chalmers, C.B., of the Treasury; and Mr. E. L. Somers Cocks, Treasurer of the Geographical Society; whilst Mr. Cyril Longhurst, the indefatigable Secretary of the Expedition, became also the Secretary of this Committee.

The Joint Committee, after arranging for this new order of things, proceeded to consider the instructions which were to guide the movements of the expedition, and as there were many scientific interests to be served there was naturally considerable divergence of opinion on points of detail, and it was many months before these were finally decided.

In the meantime my first task was to collect, as far as possible, the various members of the expedition. It was evident that there was far more work than I could hope to do single-handed, and the best assistance I could have would be from those who were to take part in the voyage. I shall give some account of the individual officers and men in a future chapter, confining myself here to the part they played in the work of preparation.

From a very early date I had set my mind on obtaining a naval crew. I felt sure that their sense of discipline would be an immense acquisition, and I had grave doubts as to my own ability to deal with any other class of men. Mr. Goschen had originally limited the Admiralty assistance in this respect to two officers, myself and Mr. Royds, who was already at work in our service. At a later date, however, the Admiralty extended this limit to include Mr. Skelton, our engineer, a carpenter, and a boatswain, and this gave us at any rate a small naval nucleus. But beyond this for a long time the Admiralty hesitated to assist us, and before the tide

turned I was almost reduced to despair of a concession which I thought so necessary.

In this matter and in many others I can never forget the assistance which was given me by the late Sir Anthony Hoskins. Sir Anthony loved to do his good deeds silently, and it was not until long after that I learnt how frequently he had lent a helping hand to the expedition. But any hesitation the Admiralty may have had in granting naval seamen did not spring from coldness towards the enterprise. The Sea Lords were at this time Lord Walter Kerr, Sir Archibald Douglas, and Admiral Durnford, and both individually and collectively they never failed to evince an interest in it, so that at length the active assistance of Sir Archibald Douglas overcame objections of principle, and the men were granted.

But this concession, perhaps the most important which the expedition received, did not come until the spring of 1901; and as, after this, steps had to be taken to select the most fitting volunteers, the chosen men did not join until very shortly before the sailing of the expedition.

Many of the officers, however, came on the scene much earlier, and whilst our new vessel was yet a skeleton the first lieutenant, the chief engineer, and the carpenter were standing by her, and were able to look into the numerous small difficulties that arose, and to inform me of them during my flying visits to Dundee. My own headquarters I was obliged to make in London, and I fixed them in the University buildings of Burlington House, where rooms were kindly placed at my disposal by Lord Esher, then Secretary to His Majesty's Office of Works.

It would not be possible for me to describe half the work that went on in this office; suffice it to say that it kept me extremely busy for six days in the week. My room soon became a veritable museum of curiosities: sledges, ski, fur clothing and boots were crowded into

the corners, whilst tables and shelves were littered with correspondence and innumerable samples of tinned foods. In the midst of this confusion I worked steadily on with all the ups and downs that such occasions will bring, sometimes in high hope that all was going well, and sometimes with the dreary feeling that by no possibility could we be ready to start at the required date.

Luckily, throughout this busy, trying time I had much assistance. Our indefatigable Secretary, Mr. Longhurst, was always willing to take fresh troubles on his already overburdened shoulders, and devoted his whole energies to the work. Of Mr. Armitage's help in matters of equipment I shall speak later on. At about this time also Mr. George Murray, F.R.S., received his appointment as temporary director of the scientific staff, and many of the details of the scientific equipment passed into his hands, where I soon became conscious they rested with safety. Mr. Murray also undertook to edit that very important publication the 'Antarctic Manual,' which provided us with a great deal of scientific and historical instruction concerning the regions we were about to visit.

But it was not all plain sailing with those who were gathered around me at this important time; not all were such staunch supporters as those I have mentioned. Amongst my most careful selections had been the person who was to hold the responsible position of ship's steward. At this time a good ship's steward would have been invaluable, but my choice proved unfortunate, and first and last caused us a great deal of trouble, although I am glad to say we were rid of him before the expedition sailed.

In this manner and with varying fortune the work of equipment proceeded. First a lengthy provision list was drawn up, the amounts being calculated for a three-years' absence; tinned meats, vegetables, flour, biscuit, butter,

sugar, and every other necessary article were ordered in due proportion, and even such minor requirements as dubbin and plate-powder were not forgotten. After this came a consideration of the clothing, and with what an assortment of this we were provided will be gathered from the pages of this narrative; for it will be seen that we had need to be prepared for every variety of climate, from the sultry heat of the tropics, through the storms of the Southern Seas, to the intense cold of the Far South. Next came the provision of the travelling equipment—sledges, tents, furs, &c., had to be thought of and selected with a care which I shall explain in a future chapter.

But the above by no means exhausts the list of subjects for which arrangements had to be made in that small office in Burlington House. Few people can realise what an extraordinary variety of articles is required on such an expedition as ours, where a ship and its crew are to be banished from all sources of supply for a lengthened period. For, besides the provision of food and clothing and such things as were obviously necessary, it is possible to enumerate a host of articles which, whilst we were equally forced to procure them, will probably not have occurred to the ordinary reader.

For instance, there were boatswain's stores, with rope, canvas, and everything necessary for the refitting of the top-hamper of the ship; carpenter's stores, with all requisites for work in that department; engineer's stores, including a vast variety of articles; ice implements of various kinds, explosives for destroying the ice, guns and ammunition, and fireworks for signalling. There were tobacco, soap, glass, crockery, furniture, mattresses, and all such requisites for personal comfort; oil-lamps and candles for lighting, and stoves for heating; medicines and medical comforts; a photographic outfit; a library of many hundreds of volumes; also a balloon

equipment; canvas boats of various kinds, huts for our shore station, instruments of many descriptions and so on almost *ad infinitum.*

It may be imagined that, large as this list of requirements was, with the sum of 92,000*l.* there should have been no financial difficulty, nor, indeed, was there; but it has to be remembered that of this large sum 51,000*l.* went to the complete cost of building the new vessel, and it was necessary to reserve more than 25,000*l.* for the wages and the contingent expenses of the voyage.

The sum which remained was sufficient to equip the expedition in the most thorough manner, but it had to be administered with economy; and though I am now conscious of many mistakes which were made from lack of experience, I think little money was wasted.

On the whole the firms with which we dealt treated us with great liberality, and supplied us with excellent goods. Many took an especial interest in the expedition, and made a very considerable reduction in the prices of the articles they supplied. Whilst it is impossible to quote all the instances of this nature, I take the opportunity of most gratefully acknowledging four cases in which goods were supplied as an absolutely free gift, and in which the donors took exceptional care that the packing should be in exact accordance with our requirements. These firms were Messrs. Colman, Limited, who supplied us with nine tons of flour and a quantity of mustard; Messrs. Cadbury, who gave 3,500 lbs. of excellent cocoa and chocolate—all that we required of these articles, in fact; Messrs. Bird & Sons, who presented us with eight hundredweight of baking and custard powders; and Messrs. Evans, Lescher & Webb, to whom we were indebted for all our lime-juice.

During these busy months of preparation which I have briefly described, the various important posts in the expedition had been gradually filled up, and now expe-

ditionary work was being carried on in many places. Some officers were in Dundee, superintending the building of our good ship; others were working on their especial subjects at the British Museum; others were preparing themselves at the Physical Laboratory at Kew; and others, again, were travelling in various directions, both at home and abroad. Of all these movements and doings the central office was obliged to have cognisance, and therefore, as can be imagined, there were not many idle moments for its occupants.

Long ago it had been decided that the 'Discovery' should be loaded with her valuable freight in London, and on June 3 she was brought round from Dundee and berthed in the East India Docks. The courtesy of the London Docks Company had placed at our disposal a large shed near this berth, and soon after the centre of interest was transferred to this spot.

Here, therefore, during the two following months, busiest of all, were gathered all those stores which were to minister to our comfort and aid our work throughout our long voyage; and here also we loaded the staunch vessel which, with her solid wooden walls, was to form our home for more than three years.

CHAPTER II

PREPARATION

Ships of former Polar Voyages—Ship Committee—Design of the 'Discovery'—Choice of a Name—Description of the Ship—Magnetic Observatory—Living Spaces—Holds, &c.—Sails—Launch of the Ship—The Officers appointed—The Warrant Officers—The Men—Division of the Antarctic Regions—Prospect of Victoria Quadrant—The Instructions—Acknowledgment of Assistance.

> Ere long we will launch
> A vessel as goodly, strong, and staunch
> As ever weathered a wintry sea.—LONGFELLOW.

IN deciding to build a vessel for the purposes of the expedition the Ship Committee made a new departure, for the 'Discovery' was the first vessel ever built in England for scientific exploration.

Few details in the great voyages of the early adventurers are more interesting to a sailor than those concerning the ships in which such voyages were accomplished. If one is inclined to wonder at the deeds of those mariners, wonderment must be greatly increased on realising the extraordinary vessels in which they were performed. Space does not permit me to touch on such a subject, but it may be interesting to note some of the vessels which have been used since the commencement of the era of scientific exploration to which I referred in the last chapter.

All four ships, the 'Endeavour,' 'Resolution,' 'Ad-

venture,' and 'Discovery,' which took part in Cook's famous voyages, had been built and used for the coal trade; they ranged from 300 to 462 tons, and Cook expressed himself very well satisfied with them, deeming them well suited for his purpose.

The 'Erebus' and 'Terror,' as I have noted before, had been bomb vessels. They had been built in the old French war, and were designed to carry mortars which discharged shells at an angle of 45°. It was these same vessels which, after they had returned from their famous Southern voyage, were lost with the ill-fated Franklin Expedition in 1845. The 'Hecla' and 'Fury,' which took part in Parry's famous voyages to the Arctic Regions, were also bomb vessels of the same class, but many of the early Arctic ventures were provided with old whalers: it soon came to be recognised what a useful type of vessel this was for ice-work.

The majority of ships employed in the Franklin Search Expedition were ordinary merchant vessels purchased into the navy and strengthened at considerable expense. Some of these which did good service, such as the 'Enterprise' and 'Investigator,' were over 530 tons. Most of these early vessels were sailing ships; the first steamers used were the 'Pioneer' and 'Intrepid'; they were about 430 tons burden, and both had been traders under different names.

In the latest Government Arctic Expedition of 1875 the two vessels employed were, as is well known, the 'Alert' and the 'Discovery.' The 'Alert' was an old 17-gun sloop especially strengthened for the service, but the 'Discovery,' though also strengthened at Portsmouth, had been the whaler 'Bloodhound,' built at Dundee for the Greenland whale trade. The contrast between these two ships for ice-work was remarkable. The 'Alert' had a bluff straight bow, whilst the 'Discovery' had the more recently designed overhanging stem, and as a result

the 'Discovery' had often to be sent ahead to force a passage in order that the 'Alert' might follow.

The lines of the 'Discovery' represented the experience gained in the whaling trade; this industry, which had flourished for so many years, and which at one time had employed more than a hundred vessels sailing out of Hull, Peterhead, and Dundee, was slowly dwindling, but then, and even much later, fresh ships were launched from time to time to compete in it. The whale, however, was growing timid, and had to be sought in new waters; the difficulties with the pack-ice were ever increasing, and success lay more and more with those ships which were capable of forcing their way through it.

As a natural result of these conditions, a class of vessels was evolved which, whilst capable of taking the same hard knocks as the older ships, had a greatly increased power for making progress through the pack-ice, and to this class belonged the old 'Discovery.' As regards lines, she probably reached the best form for such a vessel; for although others have been launched since, they have achieved greater efficiency mainly by increased engine-power. It was generally admitted by those who witnessed her performances in 1875 that the old 'Discovery' was the best ship that had ever been employed on Arctic service.

The Ship Committee which was appointed to consider the design of the new vessel for the Antarctic Expedition had all these facts vividly before it, since some of its members had occupied the most important positions in the expedition of 1875. Without giving the names of all the members, as the Committee was a large one, I may mention that amongst the most active were Sir Leopold McClintock, Sir George Nares, Sir Vesey Hamilton, Sir Albert Markham, Sir Anthony Hoskins, and Captain E. W. Creak.

This Committee, therefore, after due deliberation, decided that the new vessel should be built more or less

on the lines of the old 'Discovery'; and here it is necessary to explain more exactly why this decision was made, as it wholly rejected another and newer type of Arctic vessel suggested by the 'Fram.'

I have so often been asked whether the 'Discovery' was like the 'Fram,' and if not, why not, that I wish to make this point clear. The 'Fram' was built for a specific object, which was to remain in safety in the North Polar pack in spite of the terrible pressures which were to be expected in such a great extent of ice.

This object was achieved in the simplest manner by inclining the sides of the vessel until her shape was something like that of a saucer, and lateral pressure merely tended to raise her above the surface. Simple as this design was, it fulfilled so well the requirements of the situation that its conception was certainly a stroke of genius. But what is generally overlooked is that this quality was only got by the sacrifice of others, which, though they might not be needed on that expedition, might be very much required on future ones. In short, the safety of the 'Fram' was achieved at the expense of her seaworthiness and powers of ice-penetration.

Hence it will be seen that since the advent of the 'Fram' there are two distinct types of Polar vessels, the one founded essentially on the idea of passive security in the ice, the other the old English whaler type, designed to sail the high seas and push forcefully through the looser ice-packs.

A very brief consideration of Southern conditions will show which of these two types is better suited for Antarctic exploration, for it is obvious that the exploring ship must be prepared to navigate the most tempestuous seas in the world, and then to force her way through the ice-floes to the mysteries beyond. As yet the Southern Regions have shown no uses for the type which achieves safety at the expense of progress. It will be seen, therefore, that the

Committee had a clear issue in deciding to adopt good and well-tried English lines for its vessel, and certainly in the excellent qualities which the 'Discovery' showed, the decision was justified.

It is fair to add, however, that whilst this view commended itself so clearly to the English Committee, it was not adopted in Germany. Speaking at the Geographical Congress at Berlin in 1899, Nansen strongly recommended for South Polar work a vessel of the 'Fram' type with fuller lines; this was, in fact, an attempt to produce all qualities by a compromise, and those responsible for the construction of the 'Gauss' adopted the idea. I am not in possession of any detailed information concerning the performance of the 'Gauss' as a sea-boat or in pushing through the ice; but with a knowledge of her lines and her small engine-power, and my experience in the Southern Regions, I cannot believe she was so efficient an exploring vessel as the 'Discovery.'

The art of building wooden ships is now almost lost to the United Kingdom; probably in twenty or thirty years' time a new 'Discovery' will give more trouble and cost more money than a moderate-sized war-ship. This is natural enough: it is the day of steel, of the puncher and the riveter; the adze and the wood-plane are passing away. It must become increasingly difficult to find the contractors who will undertake to build a wooden ship, or the seasoned wood and the skilled workmen necessary for its construction.

The technicalities of the business may still remain in the memories of the older constructors, but have grown vague from disuse, and very few persons have cause to refresh their memories. And so it is all passing away; even the quaint old Scotch foreman, John Smith, who played so important a part in the building of the 'Discovery,' has finished his work and vanished from the scene. It is a strange ending to an industry which a century ago

produced those stout wooden walls that were the main defence of the kingdom.

In October 1899, when tenders for the new ship were invited, there were few replies, and only one from a firm which had recent experience of such a task. This was the Dundee Shipbuilding Company, the owners of a small yard on the Tay, which had been better known in the flourishing days of the whale trade as Stevens's Yard. Stevens had been a very well-known character in Dundee, the builder and owner of many a fine whaling ship.

Arrangements were therefore entered into with this Company to build the new vessel, and in the meanwhile the Committee's architect, Mr. W. E. Smith, had thoroughly overhauled the plans of the old 'Discovery' and drawn up a masterly specification for the new one. In March 1900 the keel of the new vessel was laid, and in a few months the massive oak frames had been raised and the busy scene of construction was in full swing.

I have spoken of this new ship as the 'Discovery,' but it was not until June that her name was selected. Many names came up for discussion, and not a few of these had already done service in the older English expeditions. It was generally considered that the most appropriate plan was to revive some old time-honoured title, and as it was seen that few names carried a greater record than 'Discovery,' that name was chosen. It is perhaps interesting, therefore, to give some idea of its history. There have now been six 'Discoveries.' The first made no fewer than six Arctic voyages from 1602 to 1616 to the regions of Hudson Bay and Baffin Bay, on one of which she was commanded by the famous navigator William Baffin. The second also voyaged to Hudson Bay in 1719. 'Discovery' No. 3 took part in Cook's third voyage in 1776. 'Discovery' No. 4 was Vancouver's ship when he discovered the insularity of the land which is named after him. 'Discovery' No. 5 took part in the 1875 expedition to the Arctic; she was

commanded by the present Sir Henry F. Stevenson, and I have already shown her fitness for the work. Our own 'Discovery' was therefore the sixth of that name and the heir to a long record of honourable service, and, what was equally important, of fortunate service, as the name 'Discovery' seems never to have been associated with shipwreck or disaster.

And here I should like to introduce the reader to this good ship which was to carry us and our fortunes through many adventures. I can do so without going into technical details, as, thanks to the interest which Mr. W. E. Smith took in his handiwork and the enterprise of the Institution of Naval Architects, a permanent record of the vessel has been established. The 'Discovery,' alas! has passed away from the paths of exploration, but the future architect of such a ship will find all the information he needs concerning her in the 'Proceedings' of the Institution I have named (April 1905).

The displacement of the 'Discovery' was 1,620 tons, but her registered tonnage, by which her size can be compared with other ships I have mentioned, was 485. Her length between perpendiculars was 172 feet, and her breadth 34 feet.

By consulting the profile drawing of the ship, the reader will get some idea of the internal arrangements, but he will scarcely realise the extraordinary solidity of the structure. Most people who have voyaged in modern ships know that between them and the sea there has only interposed a steel plate the fraction of an inch in thickness; they may, therefore, be interested to know what the side of the 'Discovery' was like. The frames, which were placed very close together, were eleven inches thick and of solid English oak; inside the frames came the inner lining, a solid planking four inches thick; whilst the outside was covered with two layers of planking, respectively six and five inches thick, so that, in most places, to bore

a hole in the side one would have had to get through twenty-six inches of solid wood.

It will give some idea of the complexity of the construction of such a ship to name the various woods that were employed in the side, for in each place the most suitable was chosen. The inner lining was of Riga fir, the frames of English oak, the inner skin, according to its position, of pitch pine, Honduras mahogany, or oak, whilst the outer skin in the same way was of English elm or greenheart. The massive side structure was stiffened and strengthened by three tiers of beams running from side to side, and at intervals with stout transverse wooden bulkheads; the beams in the lower tiers were especially solid, being eleven inches by eleven inches in section, and they were placed at intervals of something less than three feet.

All this went to give the ship a frame capable of resisting immense side strains, but, strong as she was in this respect, the rigid stiffness of the sides was as nothing to that of the bows. Some idea of the fortification of this part can be gathered from the drawing, which shows the numerous and closely placed girders and struts that went to support the forefoot. Such a network of solid oak stiffeners gave to this portion of the vessel a strength which almost amounted to solidity. It will be seen, too, how the keel at the fore-end of the ship gradually grew thicker till it rose in the enormous mass of solid wood which constituted the stem. No single tree could provide the wood for such a stem, but the several that were employed were cunningly scarfed to provide the equivalent of a solid block; and, in addition to the strong fastenings which held piece to piece, long strengthening bolts were used which ran fore and aft and securely held all together. Some of these bolts, running entirely through wood, were as much as 8½ feet in length.

The bow of the 'Discovery' was, therefore, a part

which ran little risk of damage, and a knowledge of its strength was a pleasing possession when we came to ramming the ice-floes. In further preparation for such service the stem itself and the bow for three or four feet on either side were protected with numerous steel plates, so that when we got back to civilisation not a scratch remained to show the many hard knocks which the bow had received.

The shape of the stem was a very important consideration. It will be seen how largely it overhangs, and this was carried to a greater extent than in any former Polar ship. The object with which this was fitted was often very prettily fulfilled during our voyage. Many a time on charging a large ice-floe the stem of the ship glided upwards until the bows were raised two or three feet, then the weight of the ship acting downwards would crack the floe beneath, the bow would drop, and the ship would gradually forge ahead to meet the next obstruction. This is the principle on which the ice is broken by all modern ice-breakers; and here, perhaps, I may be allowed to interpolate a remark. I have often been asked why the now well-known ice-breakers are not employed for such expeditions as ours. It is because the ice-breaker is built of steel, and, except when breaking very thin ice, is in constant need of repair; nothing but a wooden structure has the elasticity and strength to grapple with thick Polar ice without injury.

The 'Discovery's' greatest strength lay in her bows, as I have just shown; next to this, and as far aft as the mainmast, the structure, supported by numerous beams and bulkheads, still remained very strong; but further aft there was a distinct weakening, for although the sides remained equally thick, the position of the engines and boilers necessitated the omission of many of the cross-beams.

Next to this came the stern, which, with the rudder and

screw, must always form the weakest and most vulnerable part of a Polar ship. Nansen aptly defines it as the Achilles' heel. Our screw was capable of being detached and lifted up through the deck; this is a common enough device, though, as I shall remark later, the manner in which it was done in the 'Discovery' was new.

But Mr. Smith made an entirely new departure in providing us with a rudder which likewise lifted up through the deck. This plan had the single disadvantage that the rudder possessed only one pintle and brace instead of the several that are customary; on the other hand, its advantages in the facilities it offered for shifting a damaged rudder were great and easily seen. As I shall tell, we had occasion to be exceedingly grateful for these advantages.

Protection for our keel was afforded, firstly, by making every part as strong as possible; the rudder-post was an enormous piece of timber, and was secured to the keel with extra strengthening-pieces placed beneath the propeller; it would have taken tremendous forces to have strained or distorted these fixtures. But protection to this part was given yet more by the overhanging stern, an entirely new feature in this class of vessel. As can be imagined, the building of the 'Discovery' excited the keenest interest in the whaling community of Dundee. Few novelties passed unnoticed, and the peculiar shape of our stern gave rise to the strongest criticism; all sorts of evils were predicted, the commonest being that we should one day come down so heavily that it would be broken off! As events showed, this stern was a distinctly good feature: in a heavy seaway, as long as we were travelling through the water, it tended to keep the ship drier by causing her to lift more readily to the waves; to a certain extent it was a disadvantage if we happened to be becalmed and stationary, as then the rounded under-surface would come down with terrific violence, shaking the ship throughout; but these occasions were rare, and when we got amongst

the ice we reaped great benefit from it, for then, as will be seen, it formed a buffer which prevented the heavier pieces of ice from coming into contact with the rudder.

On the whole, therefore, the hull of the 'Discovery' was a splendidly strong and well-fortified structure, and the machinery was in all respects equal to the hull. The ship had two cylindrical boilers arranged to work at a pressure of 150 lbs. per square inch, and a set of triple expansion engines. The latter were designed to give 450 indicated horse power, but actually on trial gave over 500. Whilst there was nothing particularly novel in these engines and boilers, many details in connection with them had to be considered with especial care in view of the service for which they were required; more particularly was this the case with regard to the leads of steam pipes and the position of sea inlets.

In the shape of auxiliary machinery, besides that in connection with the main engines, the 'Discovery' possessed a small condenser for making fresh water, a small dynamo for supplying electric light, a strong deck winch amidships, and a very powerful capstan engine under the forecastle. In connection with the last-named, and placed close to it, there was also a small auxiliary boiler which on one occasion at least did yeoman service. All these various machines were supplied by different firms, but our excellent set of main engines and boilers were built and placed by Messrs. Gourlay Brothers, of Dundee, and to the energetic manager of this firm, Mr. Lyon, we owe the really novel feature which was embodied in our arrangement for lifting the screw.

For the benefit of those who are interested in engineering details I may briefly explain this device, as it is certainly worthy of record. As I have said, a lifting screw is a common fitting, but it has always had one disadvantage in the fact that the joint between the shaft and the screw has tended to get loose, and this has caused a very

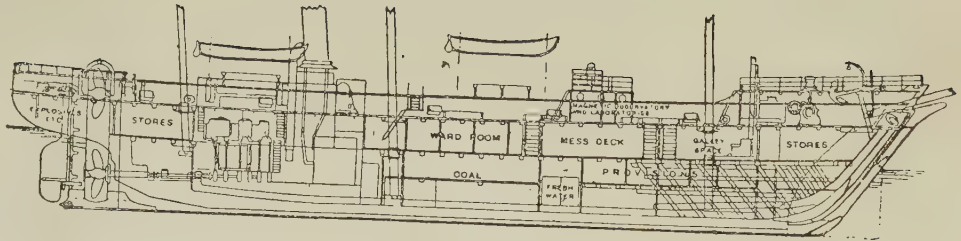
uncomfortable jarring when the engines have been revolving. The fittings in the 'Discovery' entirely avoided this in the following manner: The tail end of the shaft was made hollow, and inside it was placed an inner shaft; the outer shaft fitted into the boss of the screw on a taper; inside the boss beyond this taper was a large nut in which the inner shaft could engage; the outer shaft and the screw were kept in close connection by the inner shaft and nut, and therefore there was no loose connection to jar. To disconnect the screw, a small section of the main shaft, in front of the tail shaft, could be lifted bodily, the inner tail shaft could then be turned and freed from the nut, when both inner and outer shafts could be withdrawn together, and the screw was free for lifting. This fitting was naturally expensive, but it is certainly the most efficient that has been devised for a lifting propeller.

In the profile drawing which is reproduced, on the middle of the upper deck will be seen a deck-house marked 'Magnetic Observatory'; this was an important place, both in the building and in the subsequent work of the 'Discovery.' I have already given reason to show why the greatest stress was laid on the accuracy of our magnetic observations, and it will be clear that accurate magnetic observations cannot be taken in a place closely surrounded with iron. The enthusiasm of the magnetic experts on the Ship Committee had at first led them to request that there should be no iron or steel at all in the 'Discovery,' and when it was pointed out that this could scarcely be, they demanded the exclusion of the metals from the vicinity of the magnetic observatory. At last a compromise was arrived at, which stipulated that no magnetic materials should be employed within thirty feet of the observatory. It is difficult to realise what immense trouble and expense this decision involved. This thirty-foot circle swept round, down by the foremast, under the bottom of the ship, and up in front of the main-

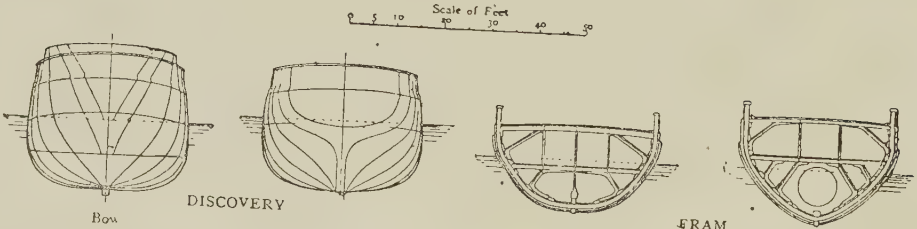
mast; everything within this radius had to be made of brass or some other non-magnetic material, and when all the fastenings of the hull and all the fittings and furniture of the ship are considered, some idea may be gathered of the difficulty; even much of the rigging, which would ordinarily have been of wire, had to be made of hemp, of a size which is rarely, if ever, used in these days. And yet when all these elaborate precautions had been taken we could not banish magnetic objects from the sacred ring, for as a critic might well have pointed out in the first place, the provision-rooms within it could not possibly have their contents preserved in brass.

Nevertheless, this care in building was by no means lost. The magnetic observations taken on board throughout the voyage required astonishingly little correction, and though the condition of perfection looked for was not achieved, it was certainly more nearly approached than it would have been in an ordinary wooden steamship.

There were several curious results of this magnetic ordinance. I might mention, for instance, that the officers outside the circle slept on modern spring mattresses, whilst those within had to content themselves with wooden battens. There was quite a small stir, too, when the buttons of some cushions were found to be made of iron, and these were immediately ripped off and replaced by leaden ones. Of course, also, the magnetic regulations caused some amusement: at one time those who lived within the circle were threatened with the necessity of shaving with brass razors. The careful rounds made by the navigator before he commenced his observations were another subject of jest: knives and all sorts of instruments had to be summarily confiscated and placed beyond the pale, much to the annoyance of their owners; and on our way home from New Zealand I remember one awful case where it was discovered that throughout a whole set of observations a parrot had been



PROFILE DRAWING OF 'DISCOVERY.'



Bow

DISCOVERY

Section amidships.

FRAM.

Section at the engine-room.

OUTLINE DRAWINGS OF 'DISCOVERY' AND 'FRAM.'

hanging on the mess-deck. It was not the inoffensive bird that was objected to, but the iron wires of its cage.

The general distribution of ourselves and our stores inside the 'Discovery' can be seen in the plan. The wardroom was a good-sized apartment, about thirty feet long and nearly twenty feet across; on each side were comparatively roomy cabins for the officers, whilst at the after-end, between it and the engine-room, lay my own cabin and that of the navigating officer. This position was by no means a catch, for in the tropics when steam was up it had the doubtful benefit of the heat given off by the boilers, whereas in the Polar winter, when we had no steam, the engine-room naturally became the coldest place in the ship, and the after-cabin suffered accordingly. The crew-space was a little shorter than the wardroom, but as it extended the full breadth of the ship it was larger; compared with other vessels it gave ample room for its occupants. The galley-space was narrowed by having compartments cut off on each side; however, it was quite big enough for our requirements. Between the fore-end of the galley-space and the after-end of my cabin were comprised the living-spaces, and the ship was designed so that this part might be kept especially warm in a Polar climate. Concerning our advantages and difficulties in this respect I shall speak more fully in the course of my story, but whilst the plan of the ship is under discussion, it may be as well to point out how we were situated. Naturally, if one wants to keep warm one must exclude the cold on every side. During our Polar winters, owing to the insulation of the upper deck, and to the fact that we piled snow on top of it, we had nothing to fear from that direction. As regards the sides, we had small difficulties which I shall mention, but the fact that cold might creep up from beneath was overlooked in providing for the comfort of our living-spaces.

It will be seen that beneath the men's quarters were the provision-rooms and holds; these, owing to the temperature of the sea outside, and the space above, never fell much below freezing point, and so the men suffered little discomfort from below, but the coal-space or bunker under the wardroom was a different matter. This was only shut off from the engine-room by a steel bulkhead, and consequently it became extremely cold and communicated its temperature to the wardroom. This difficulty would not have arisen had the decks of the living-spaces been thoroughly well insulated.

Daylight was admitted to the living-spaces through central skylights and small round decklights. There were no portholes or sidelights in the 'Discovery.'

Reference to the drawing will show the reader that the space devoted to our provisions and stores was divided into many compartments. It was very much smaller than the drawing might lead one to suppose, as a great deal of the room was taken up by the beams and girders provided for the strengthening of the ship. I do not know the exact weight of provisions and stores we carried when fully loaded, but I believe it to have been about 150 tons. And here I may add that the manner in which provisions and other stores are packed is of great importance in such an expedition as ours. The tinning of foods has advanced greatly of late years, but it is still necessary to exercise great care in selecting tins; the shape, the thickness, the care of manufacture, and the paint or lacquer employed, are all points to be observed, and as a general rule they give a good indication of the quality of the food within. Damp and rust are enemies which can be resisted successfully only by a well-made tin. The same care is necessary in selecting the cases in which these tins are stowed. For the 'Discovery,' we had them made to reduce bulk as much as possible, while for convenience of

handling we limited the weight of each case to 50 or 60 lbs.

The position of our fresh-water tanks will be seen on the drawing; the full stowage of these tanks was 25 tons. As they lay within the magic circle they also had to be subservient to the magnetic rule, and were made of zinc. The zinc was too thin, and the arrangement was not satisfactory; however, as the tanks were not used during the winter we did not suffer much inconvenience.

Our coal supply was amongst our most precious possessions, and I shall show how things went for us in this respect. The outline of the problem can be gathered from the following figures. The main bunker held 240 tons; to this two small pocket bunkers added 53 tons, and the deck cargo we took south was 42 tons. For our Southern campaign we had therefore 335 tons in all. At sea, steaming economically, we used between 5 and 6 tons a day, or with one boiler only, about 4 tons; on the occasions when we had to lie with banked fires the consumption was about 1½ ton. It will be seen, therefore, that each day made a marked difference in our stock of coal when fires were alight in the main boilers. But of course throughout our long imprisonment in the ice these fires were not lighted, and then our consumption was only such as was necessary for cooking and for warming the ship, and during our second winter we reduced this to the very moderate figure of 15 cwt. per week.

A description of the 'Discovery' would scarcely be complete without a word or two about the spread of canvas which assisted our voyage so greatly. The ship was under-masted: the mainmast from truck to keelson was only 112 feet, and this is extremely short for such a vessel, while comparatively speaking for this height of mast the yards were square (*i.e.* long), the mainyard being 60 feet in length.

The 'Discovery' was extraordinarily stiff, and could have carried a much larger sail area with advantage. As it was, the mainsail and jib were the only sails we took off for a gale, and I think rarely, if ever, have top-gallant sails been carried through such weather as ours. For the non-nautical reader I may explain that in a gale there comes a time when certain sails cannot be furled: to relieve the ship they must be either cut or blown away. That we allowed our top-gallant sails to remain spread in such weather shows our confidence in the 'Discovery's' stability as well as in our canvas and our boatswain.

But the comparatively small spread of sail was a great drawback in light winds, and the ship was an extremely sluggish sailer. Matters were rendered much worse also by the masts being placed in the wrong position. They should have been put much nearer the bows. When sailing 'on a wind' in the 'Discovery' we had to trim our sails so that everything forward was clean full while the sails on the mainmast were almost shivering. These details are somewhat technical, I fear, but it is very necessary that they should be noted for the guidance of future explorers. Masts, yards, and sails are rapidly passing away from the seas, but where the saving of coal is of such prime importance, as in the case of the Polar exploring ship, they must long remain a useful auxiliary. Although the 'Discovery' was very slow under sail alone, unless running before a strong breeze, there were many occasions when the sails proved an immense assistance to the engines.

In the foregoing pages I have endeavoured to give some description of the ship which was built at Dundee, 1900–1, and which on March 21 of the latter year was launched and named the 'Discovery' by Lady Markham. When, after gliding smoothly into the waters of the Tay, she was brought back to the dock side, it was to be invaded by a small army of workmen, to receive

her engines and boilers, to undergo her successful trials, and generally to be prepared for that voyage to the Thames in June which I have already mentioned.

From the brief manner in which I have dealt with the 'Discovery' it will be seen that the initial labours of the Ship Committee and the high intelligence of Mr. W. E. Smith had provided us with the finest vessel which was ever built for exploring purposes. If I had little cause to complain concerning the instrument thus put into my hands, I had equally little concerning the officers and men who were to assist me in using it. The manner in which they did their work and the loyalty with which they supported me will appear in these pages; but here I would wish to introduce the reader individually to that roll whose members faced hardships and difficulties with invariable cheerfulness and elected to remain at their posts whatever might betide.

Ten officers besides myself messed together in the small wardroom of the 'Discovery.' The senior of these was Lieutenant Albert B. Armitage, R.N.R. Armitage had spent a great number of years at sea, joining the training ship 'Worcester' in 1878. He had passed through that ship with credit, and after an excellent practical seamanship training in sailing ships, had been appointed to a position in the P. and O. Company's service. In this service he had remained nominally ever since, but in 1894 he had been granted leave of absence to join the Jackson-Harmsworth Expedition to Franz-Josef Land. The expedition was absent for four years, and on its return Armitage's services were not only gratefully recognised by his employer, but were acknowledged by the Royal Geographical Society, which presented him with its Murchison Award. After this he had returned to his ordinary duties as first mate on one of the P. and O. Company's ships until January 1901, when his services were again lent for Polar work, and he joined our expedition

as navigator and second in command. Armitage was an excellent practical navigator, and of the value of his Polar experience I shall speak later on. He was thirty-seven when he joined us.

Another member of our community who had seen Arctic service was our senior doctor, Reginald Koettlitz. Koettlitz was English in all but name, as his father, a minister of the Reformed Lutheran Church, had married an English lady, and settled at Dover in the 'sixties. He had been educated at Dover College, and thence passed to Guy's Hospital. After qualifying he had settled down in the quietest of country practices, where he remained for nearly eight years, and might have remained to the present time but for a sudden impulse to volunteer his services as doctor to the Jackson-Harmsworth Expedition. This act had made him a wanderer, for after four years in the Arctic he accompanied expeditions to Abyssinia, Somaliland, and Brazil; and finally, with experiences gathered in many parts of the globe, he applied for and received his appointment as medical officer to the Antarctic Expedition. As his medical duties were expected to be light, he also acted as botanist to the expedition. As far as the land flora was concerned, this post was something of a sinecure, as the Antarctic lands produce only some poor forms of mosses and lichens, but Koettlitz had also to study and collect the various marine forms of plant life which are known to science under the name of *phyto-plankton.*

Our biologist, Thomas V. Hodgson, was a native of Birmingham. With a strong desire to qualify in medicine and natural science, he had been obliged to spend many years in business. His career shows well the pertinacity which we all came to recognise in his character, for during the years when he had been tied to a business which he disliked, he had devoted his spare hours with ceaseless diligence to scientific study. At last his chance had

come, and he had been appointed to a small post in the Plymouth Biological Laboratory. From this time until he joined the expedition in August 1900 his life had been identified with Plymouth, at first in work connected with the laboratory and with a science lectureship, and later as curator of the Plymouth Museum, of which, in one sense, he may be said to have been the creator, as he guided its first tottering footsteps. Hodgson's task was to collect by hook or by crook all the strange beasts that inhabit our Polar seas, and of the manner in which he went about it these pages will tell.

Koettlitz was forty years of age when he joined the expedition, and Hodgson thirty-seven. The average age of the remaining members of our wardroom mess was little over twenty-four years, so that it may be said they had most of their lives before them, and after my experience of their services I have little doubt as to the value of youth for Polar work.

Charles W. R. Royds was our first lieutenant, and had all to do with the work of the men and the internal economy of the ship in the way that is customary with the first lieutenant of a man-of-war. He had passed into the 'Britannia' from the 'Conway' in 1890, and so joining the Naval Service had reached the rank of lieutenant in 1898. He joined us from H.M.S. 'Crescent,' then serving as flagship on the North America station, and came with an excellent record of service for so young an officer. Throughout our voyage he acted as our meteorologist, and secured the most valuable records in this important branch of science in face of difficulties which this narrative will present.

Our second naval lieutenant was Michael Barne, who had only recently been promoted to that rank. He had been educated at Stubbington School in preparation for the Navy, and had joined the 'Britannia' in 1891. Later he had served with me in the 'Majestic,' and I had

thought him, as he proved to be, especially fitted for a voyage where there were elements of danger and difficulty.

The original idea in appointing two doctors to the 'Discovery' was that one should be available for a detached landing party; but, although this idea was practically abandoned, there were few things for which we had greater cause to be thankful than that it had originally existed, for the second doctor appointed to the expedition was Edward A. Wilson. Wilson was a native of Cheltenham, and had been educated at the college of that name and at Caius College, Cambridge; after taking his degree he had qualified in medicine at St. George's Hospital, London, but on leaving the hospital ill health had obliged him to spend some years abroad. His health was not wholly re-established when he joined the 'Discovery,' but he was evidently on the mend, and his fitness for the post in other respects was obvious. In addition to his medical duties he was appointed vertebrate zoologist and artist; in the first capacity he dealt scientifically with the birds and seals, and in a manner which his appendix to this work indicates; in the second he was perhaps still more active, and it would take long even to number all the pictures and sketches he has produced of the wild scenes amongst which we lived.

I was still serving in the 'Majestic' when I received my appointment to the expedition, and it was at that time I realised that among my messmates was just the man for the post of chief engineer of the 'Discovery.' This was Reginald W. Skelton. He was a Norfolk man, and had joined the navy as an engineer-student in 1887; subsequently he had served in various ships on various stations until at last he had been appointed as senior engineer of the 'Majestic,' where I first got to know him well. One of my earliest acts on behalf of the expedition was to apply for his services, and it was certainly a very fortunate one: from first to last of our voyage

we never had serious difficulty with our machinery or with anything concerning it. But Skelton's utility extended far beyond his primary duties. I shall have reason to tell of the many ways in which he assisted the scientific work of the expedition, whilst, thanks to his ability with the camera, in the course of his work as photographer-in-chief he produced the most excellent pictures that have ever been obtained by a Polar expedition.

Our geologist, Hartley T. Ferrar, joined us only shortly before the 'Discovery' sailed. Though born in Ireland he had spent the early years of his life in South Africa, but he had returned home to be educated at Oundle School and at Sidney Sussex College, Cambridge. Events went very rapidly for Ferrar at the end of his university career; in June 1901 he took honours in the Natural Science Tripos, in July he was appointed to the Antarctic Expedition, and in August he sailed for the Far South. He had very little time, therefore, to prepare himself for his important work, but he did his best to make up this deficiency by a steady application to his books and an increased activity when he arrived at the scene of his work. As will be seen later, the result of Ferrar's work was to throw considerable light on the structure of a vast land mass, no inconsiderable portion of the surface of the earth; it was a result, therefore, that cannot but be highly important to geological science, and it was achieved by physical labour which might not have been within the powers of a more experienced geologist.

Owing to the medical rejection of a former candidate for the post our physicist, Louis Bernacchi, did not join us until we reached New Zealand. Bernacchi had been born and educated in Tasmania; in 1895 he had joined the Melbourne Observatory as a student, and had there gained his knowledge of the special physical work which he has since steadily pursued. In July 1898 he had

joined Sir George Newnes's Expedition to Cape Adare, and the valuable magnetic observations which he then made showed that he was capable of undertaking the more extensive programme connected with this science proposed for our shore station. The delicate instruments which he manipulated, and the difficulties he had with them, will be described in due course.

In the roll of the 'Discovery' I have inscribed the names of two officers who did not serve throughout the whole term of the voyage; my reason will, I think, be clear.

One of these, Ernest H. Shackleton, was forced to leave us by ill health in 1903, when he was relieved by the other, George F. A. Mulock, who remained with us until the end of the voyage. Shackleton was born in Ireland, and educated at Dulwich College; but at an early age he had taken to the sea, and as a merchant-service officer had drifted about to various parts of the world. From casual and irregular voyages he had passed to the more settled employment of the Union-Castle Line, and had already begun to make steady progress in that service when he was appointed to the 'Discovery.' His experience was useful to us in many ways, and as he was always brimful of enthusiasm and good fellowship, it was to the regret of all that he left us in 1903.

His successor, Mulock, was a sub-lieutenant in the Navy when he joined us; he was then only twenty-one years of age, but having received some excellent instruction as a surveyor in H.M.S. 'Triton,' and having a natural bent for this work, his services proved invaluable. Of this, however, I shall speak at a later date.

From what I have said of the individuals of our wardroom mess, the reader will see that, taking them as a whole, there were two rather noticeable features. The first was youth, concerning the advantages of which for a Polar expedition I could write many pages; the second

was diversity of experience; no two of us were likely to look at a matter from precisely the same standpoint. This, I think, was also an advantage: it gave us larger interests, and generally encouraged that attitude which is so necessary to the members of a small community—the determination to live and let live.

Be this as it may, we certainly had reason to congratulate ourselves on the selection of our officers, for of this there could be no clearer proof than the fact that we lived together in complete harmony for three years.

It has been said in the Navy of that useful class of individuals the warrant officers that they form the backbone of a ship's company, and certainly on board the 'Discovery' the warrant officers played a highly important part. They lived in a small berth occupying one corner of the mess-deck, and comprised the boatswain, carpenter, second engineer, and ship's steward. With one exception I had known nothing personally of these men before they joined the expedition, but I had fully realised the importance of their duties and had taken great pains to select them from amongst other men who were recommended to me by my friends. In no case could I have made a happier choice; it would be impossible to exaggerate the admirable manner in which they all did their duties throughout the voyage.

Our boatswain, Thomas Feather, was a thorough seaman, and took that intense pride in his charge which was so well known in the old sailing days. A sailor will understand well the merits of a boatswain who can make the proud boast that the 'Discovery' circumnavigated the world without losing a rope or a sail. Our boatswain, like the rest of us, under new conditions had to turn his talents into fresh channels; in the Far South all that pertained to our sledge equipment was placed in his charge, and with him rested the responsibility that everything was in readiness when we started out

on our sledge journeys. And here, as before, he proved his excellence, for I do not remember a single complaint or breakdown that could have been obviated by more careful preparation.

In his own department our carpenter, F. E. Dailey, worked with the same zealous care as the boatswain. He possessed the same 'eye' for defects and the same determination that his charge should be beyond reproach.

I speak feelingly in these matters; anyone who has been captain of a ship will know the countless things that continually get out of order, and he will know, on the one hand, how annoying it is to have constantly to call attention to them, and, on the other, how pleasant it is to feel that close supervision is not necessary. I speak feelingly, therefore, because I was saved all these minor worries. I knew that whatever was 'adrift' with the rigging, the hull, or the machinery of the 'Discovery,' it would be put right in the shortest possible space of time by the warrant officer in whose department it lay.

J. H. Dellbridge was our chief engineer's right-hand man. As the responsibilities of the carpenter and boatswain lay with the hull and rigging, so his lay in the engine-room; his duties implied that the engines must never be found wanting, and in what manner they were carried out this narrative will show.

A ship's steward is a specially important individual in an exploring vessel; he has to keep the most exact account of the stores that are expended, and of those that remain; he has to see that provisions are properly examined and properly served out, and that everything is stowed below in such a manner that it is forthcoming when required. I had difficulty in filling this post, to which I have referred, but eventually I decided to give it to C. R. Ford, who, although a very young man without experience, showed himself to be well fitted for it

in other respects. He soon mastered every detail of our stores, and kept his books with such accuracy that I could rely implicitly on his statements. This also was no small relief where it was impossible to hold a survey of the stores which remained on board.

And now I pass on to that long list of petty officers and men which completes the roll of honour of the 'Discovery.' I would that space permitted me to give to each that notice which his services deserved. There is not one name on the list that does not recall to me a pleasant memory or does not add to the splendid record of loyalty and devotion with which I was served. But gladly as I would stay my pen to discuss individual merits, I have to remember that to tell of the things we did and the things we saw are the main objects of this book, and reluctantly I leave the personalities of my sailor friends to emerge in a more casual manner from its pages.

Yet I cannot pass on without some acknowledgment of their collective efficiency and some explanation of the manner in which such a fine body of men was brought together. It will be remembered that I was serving in the Channel Squadron before joining the expedition; consequently, when the Admiralty gave permission for naval men to serve in the 'Discovery,' I had friends in each ship of this fleet to whom I could write asking them to select one or two men from those who volunteered for the service. It was a simple plan, and relieved me of the difficulty of picking out names from the very long list which would have resulted had volunteers been generally called for. I knew well that amongst British bluejackets there would be no lack of good men to volunteer for a voyage that promised to be so adventurous. Our men, therefore, came to us singly or by twos and threes from various ships; Evans, Allan, and Quartley came from my old ship the 'Majestic,' Cross and Heald

from the 'Jupiter,' Smythe from the 'St. Vincent,' and so on.

All brought with them that sense of naval discipline which they displayed so noticeably throughout the voyage. It must be understood that the 'Discovery,' not being in Government employment, had no more stringent regulations to enforce discipline than those which are contained in the Merchant Shipping Act, and however adequate these may be for commercial purposes, they fail to provide that guarantee for strict obedience and good behaviour which I believe to be a necessity for such exceptional conditions as exist in Polar service. Throughout our three years' voyage in the 'Discovery' the routine of work, the relations between officers and men, and the general ordering of matters were, as far as circumstances would permit, precisely such as are customary in His Majesty's ships. We lived exactly as though the ship and all on board had been under the Naval Discipline Act; and as everyone must have been aware that this pleasing state of affairs was a fiction, the men deserve as much credit as the officers, if not more, for the fact that it continued to be observed.

Since the return of our expedition it has been acknowledged that our labours met with a large measure of success, and it has been recognised that each officer in his particular department has added something to the advancement of scientific knowledge; and they, as well as I, will be the last to forget how much they owed to the rank and file. For my part I can but say that success in such an expedition as ours is not due to a single individual, or to a few individuals, but to the loyal co-operation of all its members, and therefore I must ever hold in grateful memory that small company of petty officers and men who worked so cheerfully and loyally for the general good.

I have now endeavoured to give the reader some idea

of the good ship 'Discovery,' and of the gallant crew which manned her; it remains to give a clearer account of the mission on which she was despatched.

It was Sir Clements Markham who first suggested that for convenience of reference the Antarctic area should be divided into four quadrants, to be named respectively the Victoria, the Ross, the Weddell, and the Enderby. Having given a brief outline of the history of Antarctic research, I will pause here for a moment to point out the prospects which each of these quadrants offered for exploration.

The Victoria quadrant included that region which had been investigated by Wilkes and D'Urville. Whilst it offered an interesting problem in the discovery of the true extension of Adélie Land, the prospect of getting to a high latitude in it did not seem hopeful.

Very little was known of the Enderby quadrant, but much attention had been called to it by the scientific voyage of the 'Challenger,' and this, with certain evidences connected with drifting ice, had caused some people to believe that a high latitude might be reached in this region. This opinion was especially held in Germany, and it was therefore in this direction that the 'Gauss' was steered.

The Weddell quadrant I have already noticed as a region of exceptional interest. More than once ships had attempted to penetrate to the open sea reported by Weddell, but they had invariably found it impossible to do so. But these vessels had not possessed the power of steam; with a steamer there seemed little doubt that Weddell's farthest point could be reached, and an explorer might determine what lay in the clear sea which had been seen beyond.

In spite of the undoubted fascination of this region, however, it appeared to the promoters of our enterprise that in the Ross quadrant lay even a fairer prospect of

important results. Though this was the region of which most was known, the discoveries of Ross, like those of all great explorers, had given rise to a host of fresh problems. Here it was certain that a high latitude could be reached, and that the work of the expedition could be conducted in the heart of the Antarctic area. Geography saw in this region a prospect of the reproduction of those sledging journeys which had done so much to complete the mapping of the Far North; meteorology grasped at a high latitude for the fixed observation of climatic conditions; magnetism found in the Ross Sea that area which most nearly approached the magnetic pole; geology was attracted by the unknown mountainous country which fringed its shores. There was no branch of science, in fact, that did not see in the Ross quadrant a more hopeful chance of success than was promised by any other region. When, therefore, Sir Clements Markham proposed that this direction should be taken by the expedition, the proposition met with complete and unanimous assent from all who were interested in the venture, and long before the 'Discovery' was built her prospective course had been finally decided.

It might be thought that with an exploring expedition such as ours, little more was necessary than to indicate the direction in which it should go, and to leave the uncertain future in the hands of those who conducted it. There is much in this view, and there is no doubt as to the wisdom of leaving to the commander of an expedition the greatest possible freedom of action, so that at no time may his decision be restricted by orders which could not have been conceived with a full knowledge of the conditions.

But instructions for the conduct of an expedition may serve a most useful purpose, both for the authorities who issue them and the commander who receives them, if, without hampering conditions, they contain a clear

statement of the relative importance of the various objects for which the expedition is undertaken.

I need not recall the several branches of science which it was proposed that our expedition should investigate, but I may point out that there were bound to be innumerable instances in which their interests clashed. The best-conducted expedition cannot serve two masters, and in pursuance of one object is often obliged to neglect others. Although circumstances will generally determine the object which can be pursued most profitably at the moment, where what may be described as so many vested scientific interests are concerned, it is obviously of advantage to the commander that he should know in what light these interests are regarded by those responsible for the expedition.

The value of instructions, then, is to place before the leader a general view of the situation, a statement of the order in which the objects of the expedition are held, and as much information as can be given without prejudice as to the wishes of his chiefs. Of such a nature were the instructions I received before sailing for the South. The original draft had been prepared by Sir Clements Markham at a very early date, and, as I have already mentioned, it came subsequently under the consideration of the Joint Committee of thirty-two members.

The draft contained many clauses relating to matters of opinion, and it was not to be expected that so large a Committee, containing representatives of so many interests, should at once agree as to their relative importance or as to the manner in which the expedition should be conducted.

In consequence of this there was much discussion, with delay that threatened to impede the progress of the expedition; but at this point the Societies wisely decided to submit the whole question to a body of smaller

dimensions, and a Committee of four was appointed to decide the matter finally.

The four members of this Committee were Lord Lindley, Sir George Goldie, Sir Leopold McClintock, and Mr. A. B. Kempe. Thanks to the practical manner in which it dealt with the question, and perhaps especially to the great administrative experiences of Sir George Goldie, all difficulties were speedily solved, and the instructions were finally drafted.

There can be no doubt that the expedition, as well as the Societies, owes much to this Committee, which, after piloting a difficult question through rough waters, furnished instructions of such a nature as I have previously indicated. In quoting these instructions I confine myself to such parts as relate to the conduct of the expedition, disregarding, for obvious reasons, those which have reference to the conditions of our service. I also omit several paragraphs which, owing to a subsequent alteration in the organisation of our officers, became non-effective.

Extracts from the Instructions under which we sailed.

. . . The objects of the expedition are (*a*) to determine, as far as possible, the nature, condition, and extent of that portion of the South Polar lands which is included in the scope of your expedition; and (*b*) to make a magnetic survey in the southern regions to the south of the 40th parallel, and to carry on meteorological, oceanographic, geological, biological, and physical investigations and researches. Neither of these objects is to be sacrificed to the other.

. . . We, therefore, impress upon you that the greatest importance is attached to the series of magnetic observations to be taken under your superintendence, and we desire that you will spare no pains to ensure their accuracy and continuity. The base station for your magnetic work will be at Melbourne or at Christchurch, New Zealand. A secondary base station is to be established by you, if possible, in Victoria Land. You should endeavour to carry the magnetic survey from the Cape to your primary base station south of the 40th parallel,

and from the same station across the Pacific to the meridian of Greenwich. It is also desired that you should observe along the tracks of Ross, in order to ascertain the magnetic changes that have taken place in the interval between the two voyages.

. . . It is desired that the extent of land should be ascertained by following the coastlines; that the depth and nature of the ice-cap should be investigated, as well as the nature of the volcanic region, of the mountain ranges, and especially of any fossiliferous rocks.

. . . You will see that the meteorological observations are regularly taken every two hours. . . . It is very desirable that there should, if possible, be a series of meteorological observations to the south of the 74th parallel.

As regards magnetic work and meteorological observations generally, you will follow the programme arranged between the German and British Committees, with the terms of which you are acquainted.

Whenever it is possible, while at sea, deep-sea soundings should be taken with serial temperatures, and samples of sea-water at various depths are to be obtained for physical and chemical analysis. Dredging operations are to be carried on as frequently as possible, and all opportunities are to be taken for making biological and geological collections.

. . . The chief points of geographical interest are as follows:—To explore the ice-barrier of Sir James Ross to its eastern extremity; to discover the land which was believed by Ross to flank the barrier to the eastward, or to ascertain that it does not exist, and generally to endeavour to solve the very important physical and geographical questions connected with this remarkable ice-formation.

Owing to our very imperfect knowledge of the conditions which prevail in the Antarctic seas, we cannot pronounce definitely whether it will be necessary for the ship to make her way out of the ice before the winter sets in, or whether she should winter in the Antarctic Regions. It is for you to decide on this important question after a careful examination of the local conditions.

If you should decide to winter in the ice . . . your efforts as regards geographical exploration should be directed to three objects, namely—an advance into the western mountains, an advance to the south, and an exploration of the volcanic region.

. . . In an enterprise of this nature much must be left to the discretion and judgment of the commanding officer, and we fully confide

in your combined energy and prudence for the successful issue of a voyage which will command the attention of all persons interested in navigation and science throughout the civilised world. At the same time we desire you constantly to bear in mind our anxiety for the health, comfort, and safety of all entrusted to your care.

Such were the principal paragraphs of the instructions which were signed by the Presidents of the Royal and Royal Geographical Societies and delivered into my hands, and when my tale is told I think it will be acknowledged that they were closely observed.

That part of my story which concerns the preparation of our venture is almost accomplished, and the reader will now understand how and why in July 1901 the 'Discovery' lay in the East India Dock equipped for her long voyage.

Of the difficulties which threatened to avert this happy accomplishment, space has only permitted me to give the briefest outline. Dr. Nansen has observed that the hardest work of a Polar voyage comes in its preparation, and my remembrance of the years 1900–1 fully corroborates this dictum; but even the troubles and trials of this anxious time had their bright side, and it is only with pleasure that I can look back on the kindly assistance which was freely given to the expedition, and to one who like myself was treading unaccustomed paths to further its ends.

Briefly and inadequately I have already mentioned the services of many eminent men who bore a share in our enterprise, but such references have by no means included all to whom our gratitude is due. It is not generally understood that in undertaking the management of our expedition the two great Societies concerned assumed an unprecedented responsibility. A great Government department like the Admiralty would have had little difficulty in preparing a dozen such ventures, because it has all the machinery necessary

for dealing with these matters; but a learned Society possesses no such facilities, because as a rule it has no need of them. Neither the Royal nor the Royal Geographical Society was organised for the equipment of expeditions, and consequently for them such a task was beset with difficulties. That all obstacles were successfully overcome is to the lasting credit of these bodies, but especially is it to the honour of those who bore the chief responsibility as officers of the Societies. I think there is little doubt that these gentlemen would acknowledge that during the troublous youth of the Antarctic Expedition they were more worried over its details than by all the other business of the Societies which they guided.

Of those who were thus forced to give much attention to the affairs of the expedition, and who did so for its benefit, were the successive Presidents of the Royal Society, Lord Lister, and Sir William Huggins; the Honorary Secretaries, Sir Arthur Rücker and Sir Michael Foster; and the Permanent Secretary, Mr. Harrison. In speaking of my own experiences, I have ever to remember the courteous and kindly treatment I received from these gentlemen. There were many reasons why my lot was still more closely cast with the Geographical Society at this time, and here, also, I can speak in the warmest manner of the treatment I received. Its Secretary, Dr. Scott Keltie, has always taken the keenest interest in the expedition, and the services he has rendered to it and to me might alone occupy a chapter of this book. To the Honorary Secretaries of this Society also, Major L. Darwin and Mr. J. F. Hughes, my thanks are due for their continual efforts to make my path smooth; and of the important services of Dr. H. R. Mill, who was at this time Librarian of the Society, I shall speak at a later date.

Though on the officers of the Societies fell the greatest

share of the difficulties which beset the expedition, there were several other gentlemen who in the midst of busy lives spared many an hour for its service.

As Hydrographer of the Navy, Sir William Wharton undertook the supply of the greater part of the instruments which we carried, and in this, as in many other ways, he showed his deep sympathy with the objects of the expedition.

On Captain E. W. Creak, at that time Director of Compasses at the Admiralty, fell all the difficulties of arranging our long and complicated magnetic programme, and of drawing up such instructions concerning it as were necessary for our guidance.

Amongst those who gave their services freely on various committees, in arranging the details of departmental work, and in adding to the interest of that excellent publication the 'Antarctic Manual,' may be mentioned Mr. R. H. Scott, Mr. Howard Saunders, Mr. J. Y. Buchanan, Dr. W. T. Blanford, Mr. P. L. Sclater, Captain T. H. Tizard, Sir Archibald Geikie, Mr. J. Teall, Professor E. B. Poulton, Sir John Evans, and Dr. A. Buchan. Not less valuable to me, starting as I did with no experience of Polar work, was the kindly advice and assistance I received from those officers who had taken part in Arctic Expeditions; and for my guidance in numerous respects I have to thank many a conversation with such eminent travellers as Sir Vesey Hamilton, Sir George Nares, Sir Albert Markham, Sir Leopold McClintock, Admiral Aldrich, Admiral Chase Parr, and perhaps most of all with my old Captain, now Admiral G. Le C. Egerton.

As will be seen, there were many who had a share in the building of our Antarctic Expedition; but even with all this kindly assistance it is doubtful whether it would ever have started had it not been that amongst the many who gave to it some hours from their busy lives

was one who, from the first, had given his whole and undivided attention.

After all is said and done, it was Sir Clements Markham who conceived the idea of an Antarctic Expedition; it was his masterful personality which forced it onward through all obstruction; and to him, therefore, is mainly due the credit that at the end of July 1901 we were prepared to set out on our long voyage and eager to obey the behest:

> Do ye, by star-eyed Science led, explore
> Each lonely ocean, each untrodden shore.

CHAPTER III

VOYAGE TO NEW ZEALAND

Arrival at Cowes—Visit of the King—Sailing from Cowes—Madeira—Crossing the Line—South Trinidad—Arrival at the Cape—Simon's Bay—At Sea in the Westerlies—Alarm of Fire—First Encounter with the Ice—Southern Birds—Macquarie Island—Lyttelton, New Zealand—Preparations for Final Departure—Departure from Lyttelton—Fatal Accident—Final Departure from Civilisation.

They saw the cables loosened, they saw the gangways cleared,
They heard the women weeping, they heard the men who cheered.
Far off—far off the tumult faded and died away,
And all alone the sea wind came singing up the Bay.—NEWBOLT.

IN spite of difficulties and delays in the delivery of the ship and in stocking her with the complicated equipment which had been provided, the 'Discovery' left the London Docks on the last day of July 1901, and slowly wended her way down the Thames.

Late on August 1 we arrived at Spithead, here to carry out that most important matter of swinging the ship. It may not be generally known that all ships, before proceeding on a voyage, are 'swung'—that is, are turned slowly round, whilst the errors of their compasses on each point are eliminated by the application of correcting magnets. Although the great care taken in building the 'Discovery' to keep all iron away from the neighbourhood of the compass rendered the use of correcting magnets unnecessary, yet it had been impossible to

banish the disturbing causes wholly, and it was most necessary to find out exactly what influence they had, not only on the compass, but on the position in which it was proposed to work the rarer magnetic instruments —that is to say, in the small central magnetic deck-house. This work was completed during the week, and on Monday morning, August 5, we made fast to a buoy in Cowes Harbour, at this time crowded with yachts assembled for the famous 'Cowes week.' In the midst of vessels displaying such delicate beauty of outline, the 'Discovery,' with her black, solid, sombre hull, her short masts, square spars, and heavy rigging, formed a striking antithesis, a fit example to point the contrast of 'work' and 'play.' Shortly before noon we were honoured by a visit from their Majesties the King and Queen. The visit was quite informal, but must be ever memorable from the kindly, gracious interest shown in the minutest details of our equipment, and the frank expression of good wishes for our plans and welfare.

In those days we thought much of the grim possibilities of our voyage. There was ever present before us the unpleasant reflection that we might start off with a flourish of trumpets and return with failure. But although we longed to get away from our country as quietly as possible, we could not but feel gratified that His Majesty should have shown such personal sympathy with our enterprise, and it was a deep satisfaction to know that our efforts would be followed with interest by the highest in the land, as well as by others of our countrymen more particularly occupied with the problems before us.

On the afternoon of the 5th the ship was crowded with visitors, whilst we did our best to make the final preparations for sea. At noon on the 6th we slipped from our buoy and, after receiving a visit from the First Lord of the Admiralty, steered to the west; a few of our

immediate relatives who had remained on board hastened to say their last farewells, and, descending into their boats off the little town of Yarmouth, waved their adieux as the 'Discovery' steamed towards the Needles Channel.

How willingly would one dispense with these farewells, and how truly one feels that the greater burden of sadness is on those who are left behind! Before us lay new scenes, new interests, expanding horizons; but who at such times must not think sorely of the wives and mothers condemned to think of the past, and hope in silent patience for the future, through years of suspense and anxiety?

Early on the 7th the Start was still in sight, but gradually it shaded from green to blue, till towards noon it vanished in the distance, and with it our last view of the Old Country.

At this time we had much to learn about the 'Discovery.' Great as may be the advantage of having a new ship, it can be readily understood that there are also serious drawbacks. In addition to our want of familiarity with the details of such a vessel, her construction, her engines, and so forth, we were ignorant of her capacity of performance under steam or sail, and we could not predict with any degree of certainty the length of time which would be necessary for our long voyage to New Zealand.

As we steered our course across the Bay of Biscay with varying baffling winds, it soon became evident that the 'Discovery' did not possess a turn of speed under any conditions; that with favourable winds we could hope for little more than seven or eight knots, whereas a very moderate head-wind might reduce her to a fraction of this speed.

Under these conditions our voyage to New Zealand promised to occupy a very long time, and it became

obvious that we could not stop by the way longer than was absolutely necessary, since delay in the date of our arrival was limited by the desire to take full advantage of the Southern summer of 1901–2 for our first exploration in the ice.

This proved a most serious drawback, as I had confidently looked for ample opportunities to make trial of our various devices for sounding and dredging in the deep sea whilst we remained in temperate climates. Some of these devices were new, and with all we were unfamiliar; and the fact that we were unable to practise with them during our outward voyage was severely felt when they came to be used afterwards in the Antarctic Regions.

On August 14 we sighted the island of Madeira, and late that night anchored off Funchal. The directors of the Union-Castle Line had generously placed a small quantity of coal at our disposal at this port, and we hoped to take it in and to complete some small repairs on the following day; but, as luck would have it, this proved a 'Fiesta' (feast day), and we were unable to get to sea until the afternoon of the 16th, though our courteous agents, Messrs. Blandy, did their best to hasten the work. On sailing from Madeira we reluctantly bade farewell to Dr. H. R. Mill, who, as an expert in oceanography and meteorology, had accompanied us on the first stage of our journey to assist us in arranging the various branches of work in these departments.

By this time, however, the routine of our scientific observations had taken form, and departments had been allotted to various officers who continued to be responsible for them throughout the voyage; and now was commenced that steady, patient record of observation on which so much of the success of an expedition must depend.

The analysis of the records of many thousands of

ocean voyages in all parts of the world has resulted in the issue of sailing directions which give the best advice as to the course to be taken by various classes of vessels. As a rule full-powered steamers alone can proceed directly from port to port; small-powered steamers and, still more, sailing ships are obliged to shape a devious course in order to take advantage of favourable winds and currents. The progress of the 'Discovery' was so wholly dependent on wind and weather that in making ocean passages she was obliged to be considered in this respect as a sailing ship, and to make long detours which involved the traversing of many hundreds of miles more than would be required on the direct track.

With the help of the N.E. trade wind we made steady progress to the south during the third week in August, but losing the trade in 17 N. lat., our daily run was so reduced by baffling winds that we did not cross the line till August 31.

The traditional customs of this event were fully observed. Father Neptune and his Tritons held their court on a platform immediately above a large canvas bath, and the numerous members of our company who had not yet been introduced to His Majesty succeeded one another in this rather trying ordeal. The victim was blindfolded, and seated on the bare edge of a plank over the bath; in front of him stood the barber, with a huge jagged pantomime razor, and the barber's assistant, with a whitewash brush and a bucket of soft soap; the unfortunate tyro was then asked questions, and the barber's assistant showed his deftness with the lather when he opened his mouth to reply; after a good deal of such rude horseplay, usually prolonged in proportion to the victim's reluctance as shown by his struggles to escape, a last push sent him floundering into the bath below.

Immediately on crossing the line we fell in with the S.E. trade wind, and stopped our engines to give them a much-needed refit. Remaining under sail during the ensuing nine days, we had some opportunity of gauging the sailing qualities of the ship, and found to our chagrin that they were exceedingly poor. Although we made some progress through the water, the course laid and the leeway made carried us far to the westward, and comparatively close to the South American coast. On September 9 we raised steam and shaped our course for South Trinidad Island. Since our departure from Madeira we had suffered some trouble from the leaking of the 'Discovery.' Much of it sprang from the hopeful prediction of the builders that there would be no leak, and in consequence of this no flooring had been placed in the holds to lift the provisions above any water which might collect, and the provision cases had been packed close down to the keel. When the water began to enter, therefore, there was no well in which it could lie, and it rose amongst the cases, causing a good deal of damage. In the old days it had always been expected that a wooden ship would leak, and the more pleasing hope with regard to the 'Discovery' was based on the fact that she possessed two layers of planking on the outside of her frames and one on the inside. In this respect, however, the fact proved rather a disadvantage than otherwise, as it made it most difficult to localise the spot at which the water was entering, and there was every chance that it passed through the inner skin at quite a different place from that at which it had penetrated the outer. As soon as we were assured of calm seas the holds were unstowed and a flooring built, but this was not effected before we had suffered considerable damage to our provisions, which we were afterwards put to some expense in replacing.

Later on we had the annoyance of seeing the report

of our leak exaggerated and represented as a danger to the ship. This it never was, but of course the water that entered had to be pumped out; and if the whole voyage is considered, the sum total of hours spent in pumping out the 'Discovery' is a large one.

The island of South Trinidad is an isolated mass of volcanic rock lying some 500 miles to the east of the continent of South America. It has been frequently visited, though not regularly, and a fascinating description is given of it in 'The Cruise of the "Falcon"' (E. F. Knight). Few naturalists have landed on it, and as it lay on our route I thought our time would not be wasted in giving our officers an opportunity of a run ashore. We sighted it on the morning of the 13th, and, approaching the western side, manned our boats and pulled for the shore. The ocean swell was breaking heavily along the whole coast, and the prospect of landing looked doubtful, but at length we found a small natural pier which seemed to afford some shelter from the heavy rollers; even here, however, our small boats were at one moment lifted high above the rocks, and at the next had dropped many feet below them. The attempt to land seemed hazardous, and on inquiring if all on board could swim, I found that one at least could not; but the shore looked too enticing to our sea-accustomed eyes to be abandoned without an effort, and, handling the boats with care, we eventually succeeded in taking advantage of the lift of each wave to leap one by one on to the rocks, and at length all except the boat-keepers were safely landed.

On the rocky shore we scattered in various directions, some of us climbing to a line of tree-ferns 1,200 feet above the sea; and the day passed pleasantly as we rambled about in search of specimens of life peculiar to the island. Little of novelty could be expected from a stay of six hours, but we had the satisfaction

of finding a few species new to science, of which perhaps the most important was a new petrel, afterwards named '*Æstrelata Wilsoni*' after our zoologist, Dr. Wilson. We left South Trinidad the same night and steered to the south to get into the region of westerly winds. On the 18th our coal supply was getting so short that I decided to proceed under sail and husband what remained of our limited stock. The wind proved very fitful, but by keeping well to the south we received it from the westward, and made slow but sure progress towards our destination.

On October 2 we arrived within 150 miles of the Cape, and, getting up steam, rounded Green Point and entered Table Bay at four o'clock on the 3rd. On the 4th we refilled our bunkers with coal, and that night put to sea once more, to take up our quarters off the naval station at Simon's Bay. It was during this short passage that we first appreciated the 'Discovery's' ability to roll: on meeting a heavy swell off the Cape Peninsula during the night, our small ship, without any sail to steady her, was swung from side to side through an angle of 90°, and as some of our furniture was not well secured, chaos reigned below and discomfort everywhere.

The main object of our stay at the Cape was to obtain comparisons with our magnetic instruments. The instruments which are used in a ship for taking observations of the various magnetic elements are unfortunately subject to change, and consequently the observations at sea are of little value unless such changes are known. Whenever it is possible, therefore, the sea instruments are compared with absolute values on land, and by this means the sea observations are corrected. The observations to be taken on our voyage to New Zealand were an important part of our magnetic survey, and it was highly desirable that the errors of the instruments

to be used should be obtained before and after the voyage—that is, at the Cape and in New Zealand.

To compare all our instruments with suitable care was a long and tedious operation. There being no fixed magnetic observatory at the Cape, the work was done in tents, kindly lent by the Admiral and pitched on a plateau beyond the hills immediately surrounding the port. It was carried out by Lieutenants Armitage and Barne, with the kind assistance of Professors Beatty and Morrison, of the Cape University; and as it could only be continued during the daylight hours, ten days passed before all the observations were completed. On board the ship every advantage was taken of this spell to refit. The rigging was set up afresh, the deck and top sides of the ship were re-caulked, the engines were overhauled, and the weed was removed from the bottom by the divers of the fleet.

At this time the war was proceeding, and things were in an unsatisfactory state; guerilla bands had penetrated so far into the Colony that martial law had been proclaimed at Capetown; the termination of hostilities seemed very remote; officials and residents took a gloomy view of the outlook. Under these circumstances it is additionally pleasing to record the great kindness which we received at all hands, the ready assistance which was offered us, both in our scientific work and in the more practical requirements of the ship, and the kindly hospitality which made our visit so pleasant. Our peaceful mission was regarded with sympathy and interest by all, and we remember with gratitude the entertainment provided for us by His Excellency the Governor, Sir Walter Hely-Hutchinson, by Sir David Gill and the members of the Philosophical Society, and by Mr. Andrews, of the Union-Castle Line. But above all we owed thanks to the Naval Commander-in-Chief, Sir Arthur Moore, who placed at our disposal

the resources of the naval dockyard for our repairs, and most generously extended to our officers the hospitality of Admiralty House. It is difficult to express how much we owed to these attentions, which smoothed our difficulties and obviated all chance of unnecessary delay.

By October 14 our refitting and the magnetic observations had been completed, and all preparations had been made for sea. In the morning Mr. George Murray bade us farewell, much to our regret; he had originally been appointed to accompany the ship to Melbourne, but owing to the unexpected delays of our voyage, I had perforce decided to go direct to New Zealand without calling at that port. The additional length of the voyage, and the delay already experienced, would have prolonged his absence from his regular work at the British Museum to such an extent that Mr. Murray thought it best to return direct from the Cape. After a last farewell to all our naval friends, at noon we slowly steamed out of the harbour, accompanied by the cheers of the warships, and proud of this last tribute of their generous sympathy.

For nearly a week after our departure from the Cape we had light westerly winds—an unusual experience, especially as we were now well in that belt known to sailors as the 'Roaring Forties'; but after the first week we had little to complain of on the score of wind, and our daily run became a much more satisfactory thing to contemplate. Towards the end of the month we had a succession of heavy following gales, and although we had put out our fires and were dependent on sail power alone, we frequently exceeded 200 miles in the day, an exceedingly good run for a ship of the 'Discovery's' type.

As time went on we became more and more satisfied with the seaworthy qualities of our small ship; she

proved wonderfully stiff, and as her sail area was small, it was rarely, if ever, necessary to shorten sail even in the most violent gales; she rose like a cork to the mountainous seas that now followed in her wake, and, considering her size, was wonderfully free of water on the upper deck.

With a heavy following sea, however, she was, owing to her buoyancy, extremely lively, and we frequently recorded rolls of more than 40°. The peculiar rounded shape of the stern, to which I have referred, and which had given rise to so much criticism, was now well tested. It gave additional buoyancy to the after-end, causing the ship to rise more quickly to the seas, but the same lifting effect was also directed to throwing the ship off her course, and consequently she was more difficult to steer. Our helmsmen gradually became more expert, but at first when some mountainous wave caught us up, we narrowly escaped broaching-to, and on one occasion we actually did so. I happened to be on the bridge at the time, with some other officers, as our small vessel swerved round and was immediately swept by a monstrous sea, which made a clean breach over her; we clutched instinctively at the bridge rails, and for several moments were completely submerged, whilst the spray dashed as high as our upper topsails. A great deal of water found its way below, flooding the wardroom and many of the cabins, from the decks of which people were soon busily picking up books and garments in a more or less sodden condition. Needless to say, we did our best to avoid 'broaching-to' again.

On October 31 we accomplished our record run under sail alone, driving before a very heavy gale. This amounted to 223 miles in the twenty-four hours. We were now gradually increasing our latitude, until on November 12 we were in lat. 51 S., long. 131 E., when we arrived in an extremely interesting magnetic area,

and I decided to steer to the south to explore it more effectively.

The exact reason for this decision is somewhat technical, but I may briefly recall that amongst the elements that came within the purview of our magnetic survey was that of magnetic force or the actual pull exercised by the earth at various places. The only data previously available seemed to show a curious inconsistency in the distribution of this force to the northward of the Magnetic Pole, where we had now arrived, and consequently it was desirable to make our survey in this region as extensive as possible. This new course took us well to the south, far out of the track of ships and towards the regions of ice.

It was almost on arrival in these lonely waters that I was awakened one night by a loud knocking and a voice shouting, 'Ship's afire, sir.' I sprang up full of 'Where?' 'When?' and 'How?' only to find that my informant had fled. As may be imagined, I was not long in getting on the deck, which was very dark and obstructed by numerous other half-clad people, who knew no more than I. Making my way forward I at length found, amidst streams of water and a slight smell of burning, the officer of the watch, who explained that the fire had been under the forecastle, but had been easily extinguished when the hose had been brought to bear on it. It eventually transpired that the rolling of the ship had brought some oilskins dangerously close to a police light, and that this had not been discovered until the woodwork round about was blazing merrily. In these days, steel ships and electric lights tend to lessen the fear of fire, but in a wooden vessel the possible consequences are too serious not to make the danger a very real one, nor to allow such a report as was made to me to be received without alarm. The risk of fire was one which was very constantly in my thoughts;

it must always loom large in a wooden ship, and I am not at all sure that it is much lessened in a polar climate, whereas in polar regions the consequences may be vastly increased. It can be imagined that after such an experience as this, I was not less likely to realise the peril, but as events turned out, I am happy to say, this was the first and last occasion on which an alarm of fire was raised: we were never again scared with such a report.

On November 15 we crossed the 60th parallel, and on the following morning much excitement was caused by our first sight of the sea-ice. At first we saw only small pieces, worn into fantastic shape by the action of the waves, but as the afternoon advanced signs of a heavier pack appeared ahead, and soon the loose floes were all about us, and the 'Discovery' was pushing her way amongst them, receiving her baptism of ice.

As night closed down on us we became closely surrounded by the pack, which consisted of comparatively small pieces of ice from two to three feet in thickness and much worn at their edges by the constant movement of the swell. The novelty of our surroundings impressed us greatly. The wind had died away; what light remained was reflected in a ghostly glimmer from the white surface of the pack; now and again a white snow petrel flitted through the gloom, the grinding of the floes against the ship's side was mingled with the more subdued hush of their rise and fall on the long swell, and for the first time we felt something of the solemnity of these great Southern solitudes.

We had now reached lat. 62.50 S., long. 139 E., and were within 200 miles of Adélie Land, discovered by Dumont D'Urville. With steam we should have had small difficulty in pushing on towards the land; but already our delays had been excessive, and we knew that we could not add to them if we were to reach New

Zealand betimes. Reluctantly the ship's head was once more turned towards the north and we passed again into looser ice. On the following day we passed a small iceberg, the only one seen in this region. Two soundings taken about this time gave depths of 2,500 and 2,300 fathoms respectively, showing that the ocean depths must extend moderately close to Adélie Land; but a third taken at our more southerly position gave 1,750 fathoms, rather indicating that the shoaling of the greater depths was commencing.

The tempestuous seas of the Southern oceans have one great feature, lacking in other oceans, in the quantity and variety of their bird life. The fact supplies an interest to the voyager which can scarcely be appreciated by those who have not experienced it, for not only are these roaming, tireless birds seen in the distance, but in the majority of cases they are attracted by a ship and gather close about her for hours, and even days. The greater number are of the petrel tribe, and vary in size from the greater albatrosses, with their huge spread of wing and unwavering flight, to the small Wilson stormy petrel, which flits under the foaming crests of the waves. For centuries these birds have been the friends of sailors, who designated them by more or less familiar names, some of which have been preserved, whilst others have been dropped for more definite titles. In the older accounts of voyages it is often difficult to recognise the birds referred to; for instance, the term 'Eglet' seems to have been applied to various species. But the 'Wanderer,' 'Sooty,' 'Cape Hen,' 'Cape Pigeon,' 'Giant Petrel,' and many others are survivals which the ordinary man still prefers to employ in preference to the scientific designation. It was the shooting of a 'Sooty' albatross by one Simon Hartley in Shelvocke's voyage that supplied the theme immortalised in the 'Ancient Mariner.'

Our zoologist Dr. Wilson was possessed of the necessary knowledge to distinguish and name our various visitors, and with his assistance most of us soon became familiar with even the rarer species. This not only added greatly to the interest of the voyage, but enabled us in turn to assist in keeping the record of such visits.

Various devices were resorted to in our endeavours to capture birds for our collection, and sooner or later examples of most of the species were brought on board. The larger albatrosses were caught by towing a small metal triangle, well baited; when a bird settled, the line would be slacked, and as it pecked at the bait a jerk of the line would sometimes catch its beak in the sharp angle of the triangle, when by keeping a steady strain on the line the bird could be landed. The smaller birds were usually caught by becoming entangled in long streamers of strong thread which were allowed to float away in the wind. A lead weight on the end of a string was also a means of capturing such birds as flew close to the ship.

The weight would be thrown over the bird so that, in falling, the string would descend across the wings. All such devices required much patience and deftness to be effective, and our most successful bird catchers, the chief engineer, Mr. Skelton, and the second engineer, Mr. Dellbridge, spent many a patient hour before they were rewarded with a capture.

The larger albatrosses rarely go as far south as the ice, but the smaller species of white albatrosses, as well as the dusky, sinister-looking 'Sooty,' accompanied us as far as the edge of the pack. But the birds which live in the regions of ice are rarely met with in the more northerly seas, though a few are widely distributed. It may be taken for granted that all the birds inhabiting the icy seas are now known; sooner or later during our voyage we saw all, but we were not often in circumstances

to make such a good bag as during our short visit to the ice in November. It was then that for the first time we saw and captured the Southern Fulmar, a beautiful bluish-grey petrel; the Antarctic petrel, a white bird with brown barred wings and head; the Snow petrel, with its pure white plumage; and two species of the small blue Prion or Whale-bird.

On November 22 we sighted Macquarie Island, which lies about 600 miles S.W. of New Zealand, and as we came abreast of it early in the afternoon I thought we might devote the few hours of daylight which remained to an excursion on shore. We accordingly anchored in Fisherman's Cove, a poorly-sheltered spot to the eastward of the island, and after pushing through thick kelp we succeeded in landing on a sheltered beach, and our naturalists were soon busily at work making collections. The western slopes of the island are bare, but on the eastern side a coarse tussock grass grows thickly and makes walking rather difficult. Our attention was principally devoted to the penguin rookeries on the beach, of which there were two inhabited by different species of birds, the larger and more numerous kind being the richly coloured King penguin, and the other a small crested penguin (*Schlegeli*).

It was the first time that any of us had seen a penguin rookery, and every detail of their strange habits proved absorbingly interesting; we were lucky enough to have arrived during the nesting season, and were able to collect specimens of eggs and of the young in various stages of development. Perhaps the most excited member of our party was my small Aberdeen terrier 'Scamp,' who was highly delighted with his run on shore, until he came to the penguins, when he was most obviously and comically divided between a desire to run away and a feeling that he ought to appear bold in such strange company. The result was a series of short rushes, made with sup-

pressed growls and every hair bristling, but ending at a very safe distance. I may add that 'Scamp' found a comfortable home in New Zealand; it was felt that an Antarctic climate would prove too much for him; and in becoming the idol of a household he quickly forgot his former acquaintances.

As night fell we weighed our anchor and proceeded to the north, sighting the Auckland Islands on the 25th, and rather foolishly shaping our course to pass to windward of them. As we came abreast of the land the wind became very fresh, and with a strong set to leeward we were for some time anxious about our prospect of weathering it. Eventually, however, we were lucky enough to clear the rocks at the northern end just before the wind increased to a full gale, which, with a heavy sea, caused us to lurch on one occasion to an angle of 55°, and kept us in considerable discomfort below. Late on the 29th we arrived off Lyttelton Heads, and on the following day were berthed alongside a jetty in the harbour.

It is most difficult to speak in fitting terms of the kindness shown to us in New Zealand, both at this time and on our return from the Antarctic Regions. The general kindness and hospitality of New Zealanders are well known to every stranger who has visited the country, but in our case there was added a keen and intelligent interest in all that concerned the expedition, and a whole-hearted desire to further its aims. Officers and men were received with open arms and quickly made friends—friends who hastened to assure them that although already separated by many thousands of miles from their native land, here in this new land they would find a second home, and those who would equally think of them in their absence and welcome them on their return.

But it is not only for private but for public kindness and sympathy that we have to thank the people of New

Zealand: on all sides we received the most generous treatment. All charges for harbour dues, docking, wharfage, &c., were remitted to us by the Lyttelton Harbour Board, and the sum thus saved to the expedition throughout the voyage was very large. The railway authorities gave us many facilities for the transport of our stores, and issued free tickets to officers and men for passage over their lines. On every side we were accorded the most generous terms by the firms or individuals with whom we had to deal in business matters. By the Christchurch Magnetic Observatory and by the Christchurch Museum we were offered numerous facilities in carrying on our scientific work. Later on, to add to this noble record of sympathetic help, the Government of New Zealand subscribed 1,000*l.* towards the expenses of the relief ship.

In considering such general kindness it is almost invidious to mention particular names, but the following gentlemen are amongst those who must be especially remembered by us for the manner in which they were ever ready to assist us: His Excellency the Governor, Lord Ranfurly; the Premier, Mr. Seddon; the Hon. C. C. Bowen; Captain Hutton, of the Christchurch Museum; Mr. Kinsey, Mr. Waymouth, Mr. A. Rhodes, Mr. Coleridge Farr, of the Christchurch Observatory, and Mr. H. J. Miller, of Lyttelton.

A great deal of work lay before us at Lyttelton. The rigging had to be thoroughly overhauled and refitted; this was taken in hand at once, and the work was much expedited by assistance given by working parties sent by H.M.S. 'Ringarooma.' The 'Ringarooma' had been directed to lend us all possible aid by the Admiral, Sir Lewis Beaumont, who, as an old Arctic traveller, took an especial interest in our mission, and the Admiral's wishes were most thoroughly carried out by Captain Rich, of that vessel. Meanwhile our magneticians

were forced to undertake again the comparison of their delicate instruments, and as this was the last occasion on which it could be done, special care and attention were necessary; but now, instead of camping in tents on a heathery hill plateau as they had done at the Cape, they were able to carry on their work in an observatory equipped with every modern convenience, and directed by an official who was not only eager to render them every assistance, but was preparing himself to take an important part in the international programme of observations which were to be taken in connection with our magnetic work in the Far South. Even with such facilities a long and troublesome task lay before our observers, but luckily their complement was now complete, for we found the last of our officers, Mr. Bernacchi, awaiting us on our arrival; so pushed had we been with many of our arrangements in England that this officer had been obliged to remain behind and to spend the weeks which could be saved by a rapid steamer voyage in getting together and studying the delicate recording instruments which were needed for our Southern station. And so, for the time being, the members of our small community were scattered once more, and whilst each was working at his special task in more than one place there was bustle and hurry to be prepared for the date of our final sailing.

At Lyttelton we found awaiting us large quantities of stores ready to be shipped for our long voyage, and since, as I have already mentioned, some of the stores in the 'Discovery' had been damaged by the leaky state of the ship, it was necessary to replace these by purchases in New Zealand. It was when I appreciated the excellence of the goods obtained in this manner I regretted that we had not relied on New Zealand for the greater part of our provisions. Were I to go again on such an expedition, I should certainly do this. Tinned meat,

flour, cheese, and, in fact, every necessary for a voyage, can be obtained at moderate prices and of most excellent quality; and the fact that in such an expedition as ours these provisions would not have had to come through the tropics, is, I think, of very great importance.

The case of butter may be especially mentioned. The tinned Danish butter which we had brought from Europe was as satisfactory as tinned butter could be, but in New Zealand we were able to purchase fresh butter which is largely exported in cases of white pine, and we found that it was quite possible to keep these cases sound through the short voyage to the Antarctic Circle, after which they could be relied on to keep for any length of time.

Owing to the damage done to our provisions, and wishing, moreover, to know exactly where everything was stowed, we thought it advisable to re-stow our holds at Lyttelton, a task which meant a good deal of labour, but ensured our being able to take advantage of every corner of the hold-space. As soon as it could conveniently be done, the 'Discovery' was docked and every effort was made to stop the leak. This, as I have pointed out, was a difficult matter owing to the several layers of planking. A thorough examination of the ship's bottom revealed not a few defects which should have been remedied before the ship was launched, but though these defects were made good and the bottom was thoroughly caulked, we found, when the ship was again afloat, that the leak was not stopped. The chagrin of our excellent contractor, Mr. H. J. Miller, was as deep as our own, and for his own satisfaction he begged that the ship might be docked again at his expense: this time he removed all the heavy steel plates that protected the bow of the ship, hoping that the fault might be found beneath them; but though more defects were made good and every inch of the bottom was examined, we

had the intense annoyance of seeing the water again entering when the ship was once more afloat. Every effort had been made, we could do no more; and the result served to show the extreme difficulty of localising such a fault in a ship of this kind. Amongst the many skilled workmen whose united labour had produced the solid structure of the 'Discovery's' hull, had been one who had scamped his task, no doubt knowing full well that he was free from all chance of detection, and for this we were condemned to suffer throughout our voyage. The leak never grew serious, and when we were in the ice it was very much reduced; but, as I have said, first and last we spent on the pumps many a weary hour that could ill be spared with so much other work to be done.

As the month of December advanced the 'Discovery' became a very busy scene; parties of men were employed in stowing every hole and corner of the available storage-space, the upper deck was littered with packing-cases of all sorts, whilst many truck-loads of stores still stood waiting on the wharf. As usual in such cases, the prospect of getting everything stowed seemed hopeless. Meanwhile, whenever permitted, flocks of curious visitors added to the confusion; but as many of these had come from a long distance, it was impossible not to accede to their almost pathetic requests to be allowed to see the ship.

At last came the day for sailing from Lyttelton, but not for our final departure from civilisation, for we yet proposed to make a short visit to Port Chalmers in the south to complete our stock of coal. On Saturday, December 21, the 'Discovery' lay alongside the wharf ready for sea and very deeply laden. Below, every hold and stowage-space was packed to the brim—even the cabins were invaded with odd cases for which no corner could be found. But the scene on deck was still more

extraordinary. Here, again, were numerous packing-cases for which no more convenient resting-place could be found; the afterpart of the deck was occupied by a terrified flock of forty-five sheep, a last and most welcome present from the farmers of New Zealand. Amidst this constantly stampeding body stood the helmsman at the wheel; further forward were sacks of food, and what space remained was occupied by our twenty-three howling dogs in a wild state of excitement. Above the deck, the skid-beams, fitted for the carriage of our boats, were in addition piled high with the woodwork of our huts, adding, as we estimated, a weight of some thirty tons, and therefore requiring to be secured with many lashings and much care. Here and there stood little groups of our friends waiting for the last handshake and to wish us Godspeed, and incidentally doing their best to separate the combatants in a dog-fight.

As may be imagined, the ship was not in a condition in which one could look forward with pleasure to crossing the stormiest ocean in the world. One could reflect that it would have been impossible to have got more into her, and that all we had got seemed necessary for the voyage; for the rest we could only trust that Providence would vouchsafe to us fine weather and an easy passage to the south.

Before noon our small company was collected on the mess-deck and a short service of farewell was held by the Bishop of Christchurch—a simple, touching ceremony gratifying to all. At 2 P.M. we cast off our warps and steamed slowly out of the harbour, but New Zealand was determined we should know how thoroughly it was interested in our venture and how heartily it wished us success. Special trains from Christchurch had borne thousands to the port to bid us farewell. Wharves and quays were packed with enthusiastic figures. It was indeed a great 'send-off'; two men-of-war—the

'Ringarooma' and 'Lizard'—steamed out slowly ahead of us, whilst no fewer than five gaily dressed steamers, crowded with passengers, and with bands playing and whistles hooting, thronged about us. Cheer followed cheer as we steamed out towards the 'Heads'; assembled in the rigging, on mast or spar, our small party of adventurers did their best to respond to this kindly expression of good feeling, until, as we entered the open sea, with a last burst of cheering and a final flutter of handkerchiefs, our kind friends turned away, and slowly we steamed out between the war-ships that seemed to stand as sentinels to the bay.

And now, whilst our hearts were full of this leave-taking, whilst with our glasses we could still discern the forms of our friends in the receding vessels, there happened one of those tragedies that awake one to the grim realities of life. Amongst our enthusiastic ship's company who had crowded into the rigging to wave their farewells, was one young seaman, named Charles Bonner, who, more venturesome than the rest, had climbed above the crow's-nest to the top of the main-mast. There, seated on the truck, he had remained cheering with the rest, until in a moment of madness he raised himself into a standing position, supported only by the slender wind vane which capped the mast. Precisely what happened can never be known; possibly the first of the sea swell caused him to lose his balance; we below only know that, arrested by a wild cry, we turned to see a figure hurtling through the air, still grasping the wind vane from the masthead. He fell head foremost on the corner of an iron deckhouse, and death was instantaneous. The body was borne through the confused obstructions on the deck to the stern gratings, and covered reverently with the Union Jack, whilst sadness and gloom descended on the ship and damped for the time all thought of our future in the South. Though

this was on Saturday, it was not until Monday that we arrived at Port Chalmers, owing to delay from a strong head wind. Captain Rich, of the 'Ringarooma,' had kindly promised to make arrangements for the funeral of our poor shipmate, and though we only arrived at 4 P.M., an inquest was immediately held, and the body buried with naval honours at 6 P.M. Bonner was a smart young seaman, already popular on board, and his untimely death was much felt; but in the busy life we were now leading there was little time for sad thought, and the gloom of this unfortunate accident was rapidly dispelled in the activities of the voyage.

Of all the stores we carried, coal was perhaps the most important, and I had determined to wedge in every ton we could carry, more especially as, through the generosity of Mr. John Mill, of Port Chalmers, such coal as we received there was a free gift.

Early on the morning of the 24th we managed to increase our already crowded deck cargo by the addition of 45 tons of coal, which with 285 tons already in the bunkers, brought our total up to 330 tons, a quantity which, although it may not sound great to those who know the consumption of modern steamers, sufficed for all our needs for more than two years.

At 9.30 A.M. we left the wharf after saying farewell to the few friends who had gathered in the port even at this early hour. The 'Ringarooma,' to whose officers and men we were so deeply indebted for assistance in the past, 'manned ship' and cheered us yet once again, and soon, in company with a tug, we were wending our way down the long, tortuous channel which leads to the sea.

By noon we were clear of the harbour bar, with a good offing, and with a fresh breeze from the N.E., we loosed our sails, and were soon briskly bowling along towards the south under steam and sail. A hoarse shout and a hoarser whistling from our friendly tug, a final wave from

the signal station on the cliff, and we were away. The last view of civilisation, the last sight of fields, and trees, and flowers, had come and gone on Christmas Eve, 1901, and as the night fell, the blue outline of friendly New Zealand was lost to us in the northern twilight.

CHAPTER IV

SOUTHWARD HO!

Steering to the South—Fog—Icebergs—Entering Pack-ice—Life in the Pack—Nature of Pack—Slow Progress—'Watering Ship'—Southern Edge of Pack—The Ross Sea—First Sight of Victoria Land—Cape Adare—Danger in the Pack—Coulman Island—Heavy Gale—Landing in Lady Newnes Bay—Killing Seals—Wood Bay—Cape Washington—Coasting South—Landing in Granite Harbour—A Well-sheltered Spot—McMurdo Sound—Stopped by the Pack—Turning to the East.

> In fog and heavy weather,
> Through wildering sleet and snow,
> We fought the ice together,
> On a track where no ships go.—ANON.

CHRISTMAS DAY, 1901, found us on the open expanse of the Southern Ocean, but after such a recent parting from our friends we had none of us much heart for the festivities of the season, and the day passed quietly.

The wind held fair for our voyage, at first from the N.E., but gradually shifting round to the west. At noon on the 26th we were able to stop engines, and our heavily laden ship plunged on towards the south under all the canvas that could be spread.

Although as a rule there are fewer gales to the south of New Zealand at this time of the year than at any other, it is not at all possible to rely on fine weather, and in the

fact that we escaped a 'blow' whilst traversing these stormy seas we had to congratulate ourselves on exceedingly good fortune. The 'Discovery' had little to fear from the worst gales when in good sea trim, but at this time had we encountered a heavy sea the consequences would have been exceedingly unpleasant. We must inevitably have lost much of our large deck cargo: the masses of wood on the superstructure would have been in great danger, whilst all our sheep and possibly many of the dogs would have been drowned.

As the days went by and we approached the Antarctic Circle, we felt how exceptionally fortunate we were in the continuance of fine weather. Although on the 28th the wind failed us and we were obliged to raise steam, on the 29th we were again favoured by a fresh breeze, and fell back once more on our policy of using the sails and saving the coal.

On the 31st we were in lat. 61 S., the temperature of both sea and air had fallen to 39°, and we had daylight throughout the twenty-four hours; but we now fell in with one of the commonest evils in these latitudes, a thick fog, and as we did not know how soon we might come upon icebergs, a very sharp 'look-out' was necessary.

The fog remained with us until the afternoon of January 2, occasionally lifting for a few hours, but again descending like a thick pall, and giving us at least one reason for being resigned to our very limited speed of five knots. A fact that adds to the depressing effect of a fog is that one's friendly companions the sea birds disappear, and one realises a curious sense of desertion as one peers into the unbroken grey, wondering when some monster iceberg will loom up, and prepared for instant action to avoid collision with it.

On the afternoon of the 2nd the weather cleared, and

shortly after we sighted our first iceberg in lat. 65½ S. Other bergs soon rose above our horizon, and in the evening we counted seventeen about us, none more than four or five hundred yards in length, and although generally of a tabular shape, they were not more than 90 or 100 feet in height.

The nature and origin of the southern iceberg have always been a subject of some mystery. In the Northern Hemisphere, where glaciers push down into the sea, fragments, often of considerable size, become detached and are carried by currents to decay in milder climates.

Early Southern voyagers had doubtless a knowledge of these northern bergs, but in the southern oceans they met with masses of ice incomparably larger than anything known in the North, and to these they gave the name of Ice Islands, or often enough went yet further and named them as new lands. Even Cook preserves the name of Ice Island in describing the long tabular berg so typical of the Southern Regions.

Except in cases where they have suffered denudation or have lost their stability and capsized, the shape of Antarctic icebergs is uniform: they have all a flat top and wall sides, and appear to have broken quietly away from some huge sheet of ice of which they formed a part. In 1854 an iceberg of this description was reported as fifty miles in length and 150 feet in height. Several accounts give thirty or forty miles as the length, and the height has been even stated to be as much as 400 feet. The longest berg reported by Ross was four miles long and 150 feet in height, but he gives a greater height for many others. The 'Challenger' saw bergs of at least four miles in length and 200 feet in height. The largest berg we saw was aground off King Edward's Land, and we estimated it as about seven miles long and 200 feet high. Doubtless some of the larger dimensions here given are exaggerated, but in view of the fact that, as

I hope to show, icebergs can be detached from a fixed but floating mass of ice, I see no reason why their length should be limited.

The whole subject of Antarctic icebergs is of more than purely polar or scientific interest, since they drift into more northerly latitudes, and become a formidable danger in the navigation of the Southern Seas. In the southern trade routes voyages would be shortened greatly by taking a high latitude, but the danger of encountering these huge masses of ice has recommended a longer but safer route, and of late, I understand, the steamships of the New Zealand Company have been accustomed to take a yet more northerly course for this reason.

The bergs we now saw were comparatively small, and our course did not take us close to any, but even at a distance it was possible to realise the unpleasant shock that would be experienced by suddenly encountering them on a dark night, or in such a fog as that from which we had just emerged. Before our voyage ended we had ample opportunity of appreciating what unpleasant neighbours they may prove under such conditions.

On January 3 we had left our first group of bergs behind us; early in the morning we crossed the Antarctic Circle, little thinking how long a time would elapse before we recrossed it. We had at length entered the Antarctic Regions; before us lay the scene of our work; the struggles and trials of preparation and the anxiety of delays were over, and the haste of our long voyage was forgotten in the fact that we had reached the field of our labours in time to take advantage of the best part of the short open season in these ice-bound regions. During the night we had encountered the first of the scattered fragments of sea-ice which form the outriders of the pack, and soon we were passing through

loose streams of ice, feeling again the slight shocks as our ironclad prow forced a way through the honeycombed floes.

Having raised steam in one boiler, at 2.30 we stopped and took a sounding, finding bottom at 2,040 fathoms. The pack was now on all sides of us, but so loose that there were many large pools of open water, in one of which we stopped for our sounding and to put over our dredge. It is almost impossible to sound or dredge in thick pack-ice, owing to the danger of entanglement of the lines, and this was to us a very great drawback, because in pursuing our general explorations it was constantly necessary to enter the pack, and consequently the opportunities for carrying out such interesting operations as sounding and dredging were largely reduced.

The belt of pack-ice into which we had now entered was that which was traversed for the first time by Sir James Ross in 1840. We had therefore fully expected to meet it more or less in the latitude in which we actually did so. In general terms it is the ice which freezes over the Ross Sea in the winter, and which is broken up by the spring gales and drifts to the north, forming a band across the sea on this meridian. Later in the year, still drifting northward, it becomes scattered, leaving for a brief season an open sea route to the south.

During our long stay in our winter quarters we were able to observe to some extent the breaking-up and clearing of the Ross Sea, which goes to form this line of pack, and I shall refer to it in due course. In our passage through it we had usually an overcast sky; this affords the best condition for that noticeable phenomenon the 'ice-blink,' the name given to the white reflection thrown on the clouds by the snowy surface of the pack. The polar voyager, when cruising in an open sea, soon becomes familiar with the patchy white sky

which indicates the presence of ice long before it is visible from the deck; and in like manner when forcing his way through the pack he looks eagerly for the dark sky shadows which surmount the pools of open water, by entering which he may hope to find his progress made easier.

And now for several days we were destined to force our way through grinding floes, making for the open pools, and taking advantage of every favourable lead when the ice loosened. The pack is far from being a desert; life abounds in many forms. As we receded from the open sea the albatrosses and various oceanic petrels silently vanished, but their place was taken by other and equally interesting birds; around us flew the blue-grey southern fulmar and the Antarctic petrel, with brown barred wings and head, and a white breast; now and again a giant petrel would come lumbering by, an unwholesome scavenger, ready to gorge himself to repletion on such carrion as might catch his vulture eye. These birds are met with far and wide; they vary much in colour from black to the lighter shades of brown, whilst there are a very large proportion of pure albinos. Occasionally a pugnacious skua gull would flap past, pausing to make some less formidable bird disgorge his hard-earned dinner. But the pleasantest and most constant of our winged visitors was the small snow petrel, with its dainty snow-white plumage, relieved only by black beak and feet and black, beady eye. These charming little birds are everywhere in the pack-ice, capturing for their food the small crustaceans which the sea washes over the surface and into the caves of the worn floes.

The squawk of the penguin was constantly heard, at first afar and often long before the birds were seen; curiosity drew them to the ship, and suddenly their small figures appeared on a floe at some distance, only

to skurry across and leap into the water on the near side, when with what seemed extraordinary rapidity they bobbed up again, shooting out on to the surface of some floe quite close to the ship. Here they paused and gazed at us with open-eyed astonishment, occasionally uttering a prolonged call, apparently to attract any of their fellows that might be in the neighbourhood. As the ship forced her way onward, these merry little companions would again and again leap into the water, journeying from floe to floe in their effort to find out what it all meant. Some of the sailors grew very expert in imitating their call, and could not only attract them from a long distance, but would visibly add to their astonishment when they approached.

In all parts of the pack seals are plentiful and spend long hours asleep stretched out on the floes. The commonest kind is the crab-eater or white seal, but the shorter species, the Ross seal, is not infrequently met with; whilst here and there is found the sea leopard, ranging wide and preying on the penguins, or even on the young of its less formidable brethren. It is curious to observe that both seals and penguins regard themselves as safe when they are out of the water. In the sea they gain their livelihood as best they can with the chance of being snapped up by each other or by the voracious killer whale, and in that element Nature has made them swift and alert to prey or to avoid being preyed on. But once on the ice or on land they have known no enemy, and can therefore conceive none. The seal raises his head only on your near approach, and then with but little alarm, whereas it is often difficult to drive the penguin into the water; even when chased it will still avoid the water under the impression that the sea is really the sole source of danger.

To add to our collection, whenever seals were seen ahead, the ship's course was altered towards them, and

when sufficiently close a bullet gave the quietus to our intended specimen; the best shots were requisitioned for this purpose in order that the skin and skull should be damaged as little as possible, and to avoid unnecessary pain. Once or twice the animals thus killed had to be secured with a boat, but generally it was possible to carry a rope over the floe and take a hitch round the body, when willing hands would soon hoist it over the side.

We had not proceeded far into the pack when our upper deck became a busy but gory scene, for in one part men were skinning our prizes in the shape of seals and penguins, whilst elsewhere it was thought advisable to turn our sheep into mutton, and soon we had an array of carcases which made an excellent show, but which, alas! did not represent a great supply when the number of mouths on board was reckoned. However, we determined to consider this mutton a luxury to be kept for the winter, and to be eked out with the greatest care. Fresh meat will generally keep for a long time when hung in the rigging of a ship at sea, but here we had the advantage of temperature, and our carcases soon became to all intents and purposes frozen mutton.

The preservation of seal skins is not a light task: the skin is taken off with the thick layer of coarse fat or blubber which surrounds the body, and has then to be flensed or freed from this blubber, when it is placed in a cask with brine.

Sunday, January 5, we determined to keep as a somewhat belated Christmas day, and after the morning service and a special dinner, we tied the ship up to the largest piece of floe-ice we could find, and although this only measured 100 yards across, it proved sufficient for our purpose, which was to make our first attempt to use the Norwegian snow shoes or ski. With very few exceptions we had none of us used ski before, and con-

sequently our first trial caused vast amusement; but even in such a short time it was possible to see signs of improvement, and before the afternoon ended races were organized and figures were darting about in all directions, with constant collisions and falls and much laughter. In the evening we pushed on once more, and whilst the ice crashed against our bows and came grinding along the side, a sing-song was held below with choruses that went far to drown the outer tumult.

The position of officer of the watch in the pack was no sinecure; he had to be constantly on the alert to avoid contact with the heavier floes and to pick out the easiest path for the ship. When the pack was open his best position was in the 'crow's-nest,' where he could first see the open patches of water and the heavier streams of ice, but in thicker pack he could often handle the ship better by 'conning' from the bridge, and at such times he had to be constantly giving fresh directions for the movement of the helm. Progress through the pack depended very largely on the care with which the ship was handled; often, after forging slowly ahead for some time, an incautious movement of the helm would bring us in collision with some heavy piece of ice, and the ship would be brought to a dead stop; sometimes by pushing on, the obstruction would be slowly forced aside, but oftener it was necessary to reverse the engines and seek a new direction.

The floes of this pack-ice through which we were now passing varied very greatly in character. Generally speaking, they increased in area as we advanced to the south, and this might well be expected, as we did not lose the ocean swell until we were 100 miles south of the northern edge. There were very few signs of pressure; only here and there a more ancient floe could be seen with ridged hummocks evidently produced far from

its present position, but everything seemed to give the impression that the ice had been constantly opening out and allowing fresh ice to form in the channels thus left free. This would produce sheets of ice of varying ages, and when the sheets broke into pack, rupture would naturally take place along the joints and would produce in close association floes of varied thickness and character. The nature of sea-ice depends largely on the temperature at which it is produced, and, in turn, when the ice arrives in warmer water the process of decay seems to depend on its nature. All the ice we met with in the pack was undergoing decay, but whilst the older snow-covered floes were more or less completely honeycombed, the younger ice seemed to have become merely very sodden and brittle. Progress was not rapid in the pack; on January 6 our latitude was 68.20 S., in long. 175 E., and we had only made thirty-five miles in the last twenty-four hours. The ice was now so close that we could make no headway with the power of the single boiler, and we were obliged to light up both.

Whilst waiting for our second boiler to be prepared, we took the opportunity of replenishing our stock of water. Although fitted with condensers, to have produced water for the engines and general ship purposes with them would have necessitated a large expenditure of coal. By far the most economical plan was to obtain water by melting ice, and for this purpose we had immediately inside the engine-room, two long tanks fitted with steam coils, in which blocks of ice or snow could very speedily be converted into water and supplied to the engines, or wherever else it might be required. Our fresh-water tanks had a considerable capacity, but every now and again we were forced to stop and refill them, and after selecting the most promising floe the ship would be secured to it, and all hands set to work to dig out and pass on board the blocks of snow.

'Watering ship' was always a very busy scene, and since the hours spent at it were so much loss to our exploring season, it soon became the custom for the officers as well as the men to share in the work. As the pack-ice is frozen sea-water, it may be a surprise to many that fresh water can be obtained from it, and it should be explained that for making the fresh water one does not take the ice itself but the snow which has fallen on its surface; in many cases this is only a thin layer, so that it is always advisable to secure a floe which has been hummocked, as about the pressure ridges the snow will lie deeper than in other parts. At first we were rather inclined to scorn floes that were not very irregular in surface, but we soon found that what meant a great deal of snow to us made a very small hole in their burden, and that we could easily satisfy our requirements from comparatively insignificant ice-floes. After the first few occasions, therefore, as soon as we had decided on 'watering ship,' it took us very little time to select our floe and to run the ship alongside it, when ready men would leap out with the ice-anchors, and after planting them securely would attach our ropes; directly the ship was secured the digging party would swarm over the side with picks and shovels and boxes, a few would dig away with the picks whilst others bore the filled boxes or large blocks across the floe, and others again stood ready to transport these over the side and on to the deck; the heap that was thus made was reduced as fast as the tanks could be fed, but generally the work was so vigorously carried on that the supply exceeded the immediate demand and a large deck-heap had to be gauged to determine the moment at which it would be wise to say, 'Hold, enough!' These words spoken, all would troop on board, the ice-anchors would be uprooted, the engines revolved, and we would push on through the pack once more; in this systematic manner

we could provide ourselves with many tons of water with a halt of one or two hours.

We made better progress again with both boilers, and as we ground through and overturned broken fragments, it was astonishing to see the extent to which the under-ice was honeycombed. Many of the overturned blocks showed under-strata of a reddish yellow colour due to the presence of diatoms; it was surprising to find that these microscopic plants could be caught in the freezing water in such vast quantities, although our surface tow-nets at this time were producing large hauls.

Tow-netting had been a very great source of interest to many of us throughout our voyage from England; our original tow-nets were designed for use only when the ship was drifting; constructed of very fine meshed silk, they were intended to capture the microscopic plants which inhabit the surface waters of the sea. By increasing the length of the net and largely reducing its aperture, we found that we could use it whilst the 'Discovery' was travelling through the water at her ordinary speed, and thus daily explore this most interesting form of life. Although Dr. Koettlitz performed all the serious work in this department, many of us, in a more amateurish fashion, were interested in examining the strangely beautiful forms revealed by the microscope in these catches. It was strange to have sailed the sea for many years in entire ignorance that such things were. Our attempts to manufacture a speed-net to capture the small crustaceans and other surface beasts were not so successful. Mr. Hodgson, our biologist, in whose department these were, reported that the delicate organisms were hopelessly destroyed, and came up 'all heads and tails.' The *phyto-plankton*, or plant life of the surface-waters, changed greatly on our advance to the south, and many beautiful forms of the tropic and sub-tropic seas gave place to vast quantities of diatoms. Since

this life possesses no power of locomotion, under certain conditions it must form a guide to the surface currents of the ocean, and when further exploration has been made, as startling facts will be obtained from such data in the South as have already been established in the North.

On January 6 the swell ceased and floes increased to four or five acres in extent, and late at night they were almost a mile in length, but very rotten; a touch from our iron prow caused long cracks to fly out in all directions, into one of which the ship would glide and gradually gather way for the next obstruction. By the 7th we were in lat. 68.32 S., having only made thirty-two miles in the past twenty-four hours, but in the evening a considerable amount of 'open-water sky' appeared ahead, and soon after the ice slackened greatly, and we passed through a number of large water-holes. A fine following breeze in the evening enabled us to shut off steam in all but the thickest places.

Since our capture of seals we had been regularly feeding on seal-meat, and on the whole, even at this time, we found it palatable: there are naturally prejudices to be overcome in taking to a new meat, and the seal being a very full-blooded animal, his flesh does not look pleasing before it is cooked, and afterwards it has a very dark mahogany colour, which is not attractive. It is almost impossible to describe the taste of a seal; it has a distinctive flavour in a similar degree to beef and mutton, but it cannot be called 'fishy,' or like anything else that is generally known. It is a very strong meat, and in food value quite equal to the best beef. But the great drawback to the seal is that there is no fat other than blubber, and blubber has a very strong rancid taste and a most penetrating smell. At this time blubber was to us an abomination both in taste and smell, and the smallest scrap that had inadvertently been cooked with the

meat was sufficient to put us off our dinner. Later on we grew indifferent to this smell, and to some extent to the taste, but except under the stress of great hunger we have no record of blubber being enjoyed. Later on, moreover, we came thoroughly to enjoy our seal steaks and to revel in the thought of seal liver or kidneys; whereas I find my diary records very doubtful expressions of pleasure with regard to all these things at this time.

Early on the morning of the 8th, behind the ice-blink to the south, could be seen a strong water sky, and soon the officer of the watch hailed from aloft the glad tidings of an open sea to the south, the ice-floes became smaller, and we soon entered a belt where the ice lay in comparatively small pieces, closely packed and grinding together on the slight southerly swell. This extended for about 1½ mile, and, pushing through it with steam and sail, we at length reached the hard line where the ice abruptly ended, and from whence to the south could be seen nothing but a clear sea.

Such a well-defined limit to the pack clearly indicates the prevalence of southerly winds at this season; it is obvious that the wind will get better hold on the floes in loose streams of ice than on those in the main pack, and hurry them along until they join the slower-moving main body.

Our pleasure in once more reaching open water may be imagined. During the past four days we had made little more than 200 miles, expending the precious coal which would have taken us three times that distance in an open sea. Although we could congratulate ourselves on getting through, it was evident that we had encountered a heavier obstruction than had Sir James Ross in first entering this sea in 1840, when, even in his slow sailing ships, he had been able to penetrate this pack in four days.

As we entered the open sea the thick pall of leaden clouds, which had remained persistently over us in the pack, rolled away, and the sun shone forth in a clear sky. Furling our sails, we obtained in lat. 70.3 a sounding of 1,480 fathoms, indicating that we were on the verge of the Antarctic land plateau. We celebrated our successful penetration of the pack by splicing the mainbrace, and at our modest dinner in the wardroom we drank to the future in champagne, so that the shout of 'Land in sight' at 10.30 P.M. only added to an already joyful frame of mind. All who were not on deck quickly gathered there, to take their first look at the Antarctic Continent; the sun, now near the southern horizon, still shone in a cloudless sky, giving us full daylight. Far away to the south-west could be seen the blue outline of the high mountain peaks of Victoria Land, and we were astonished to find that even at this great distance of more than 100 geographical miles we could clearly distinguish the peaks of the Admiralty Range.

The course was directed for Robertson Bay, but when within forty or fifty miles we again fell in with loose streams of pack-ice, and once more repaired to the crow's-nest to 'con' the ship through. At 4 P.M. on the 9th, after much turning and twisting to avoid the heaviest masses of ice, we arrived off the entrance of Robertson Bay, and forcing our way through a heavy band of pack-ice at the entrance, eventually reached the open water within the bay. Robertson Bay is formed by the long peninsula of Cape Adare, within which, standing but slightly above the level of the sea, is a curious triangular spit, probably the morainic remains of the vaster ice conditions of former ages.

It was on this spit that the expedition sent forth by Sir George Newnes, and commanded by Mr. Borchgrevink, spent their winter in 1896, the first party to winter on the shores of the Antarctic Continent. We came to

anchor under its shelter in 15½ fathoms, and soon had our boats ready to carry us to the shore.

We landed as best we could over the grounded floe-ice which fringed the shore, and beyond which lay the level plateau or beach of pebbled basalt, extending for about three-quarters of a mile to the foot of the cliffs, which rose abruptly with dark frowning aspect to a height of over 1,000 feet; a few ponds of melted snow occupied the slight depressions in the plateau, which elsewhere formed the nesting-place of countless thousands of Adélie penguins, and these small creatures were not content with the beach, but had formed their nests on the steep hill-sides, even to a height of 1,000 feet.

Members of the extended colonies were constantly moving up and down on the regular beaten tracks, which lead from the sea to their elevated nests; they walked erect, and evidently found it a most difficult and laborious task to climb the steeper places. There can be little doubt that the occupants of the highest nests must take considerably over an hour to make this journey, and when it is considered that this is all waste time out of their day's fishing, it is difficult to understand why they should choose these very elevated positions. But we found later on that there were far more of these penguin rookeries than we supposed, and a little thought showed that a rookery has certain requirements that are not often found in the Antarctic Regions. It must have comparatively easy access to the sea at a spot where the fast ice breaks early in the season, and where the floating ice is not likely to pack. As long stretches of the coastline are fringed by an ice-cliff, such places are not too frequently met with, and I am inclined to think that in most cases, if not in all, they are tenanted by colonies of this pushing, energetic little penguin; and it may be, therefore, that it is want of room alone that causes them to nest in such apparently inconvenient places.

In every respect these small birds afford a fund of interest. Their winter is spent in the pack-ice to the north, but with regular migratory habits they suddenly appear at their rookeries in September or October, and crowding in every available spot, they scrape a few pebbles together into the rudest form of nest and lay their eggs. In due course the little brown-coated chicks are hatched out and begin and continue their life in an almost ceaseless clamour for food, which the parent birds provide with indefatigable patience and zeal. Things continue thus until the chicks have grown to full stature and have shed their brown coats of down for their maturer white-breasted plumage, when they are led to the water by the older birds, and, in spite of much protest, rudely pushed in. Henceforth, it is to be supposed, they must fend for themselves, and the rookery once more becomes a desert.

On our arrival at Cape Adare the young birds were already well grown, and despite the very pungent and decided odour of penguin which assailed our nostrils, we continued to watch the antics of these queer inhabitants with absorbing interest.

Round and about the clusters of penguins, with their busy comings and goings and their ceaseless chatter, were gathered a number of the light-brown skua gulls. One could have imagined them to be dwelling on the greatest terms of friendship with the penguins until one saw some unfortunate penguin chick wander from its immediate company, when with a swift swoop a watchful skua would descend on it and in an instant its life was ended, and its yet quivering little form was being torn by its rapacious enemy, whose own nest and chicks might lie but a few yards away.

In the centre of the Cape Adare beach still stands the hut used by the members of the Southern Cross Expedition, and scattered about it we found a considerable quantity of provisions. The hut is in very good condition,

and in such a climate might well remain so for many years to come. Should some future explorers traverse this region, it is well to know that here they possess a retreat in case of emergency, as, although they may not find all the provisions in good condition, a fair proportion is likely to be found so, and at this spot there would always be abundance of food in the shape of seals or penguins.

There is always something sad in contemplating the deserted dwellings of mankind, under whatever conditions the inhabitants may have left. We could only wander about and imagine the daily life of the party until our physicist, Mr. Bernacchi, joined us. This officer had been one of this small party of eight souls, and here on the spot he recalled the past and told us of the unhappy death of one of his comrades, the naturalist Hanson, now lying buried on the hill-top 1,000 feet above our heads. The dying man had requested that he should rest there, and slowly and laboriously his body was borne up the steep hillside to the chosen spot. So there rest the remains of the only human being who has found burial on this great Southern Continent, and above his body still stands, in touching memorial, a plain wooden cross.

Our energetic magnetic observers, Armitage, Bernacchi, and Barne, were soon at work with their instruments amongst the penguins, whilst the naturalists wandered farther afield in search of specimens. The search was not without result, as, besides specimens of rock and moss, several species of birds were collected. Amongst the high rocks the small Wilson petrel was found nesting, and two eggs were obtained. On the beach were collected some white giant petrels as well as the commoner brown ones. On entering the bay we had disturbed one of these greedy birds taking a siesta on a floe, and so gorged with food that it could barely fly.

The scene in the bay after we had returned for our late evening meal was very beautiful; the surface was

calm and placid, beyond it the sunlight fell on the bold peaks and splendid glaciers of the Admiralty Range, the sharp summits of Mounts Minto and Adam were well defined against a clear sky, whilst the lofty peak of Sabine was lost in a mystery of fleecy cloud. The placid, deep shadowed sea was dotted with streams of brilliantly white pack-ice, whilst here and there a table-topped iceberg showed the sharpest contrast of light and shadow as the sun fell on its smooth, steep sides. The tide was making out of the bay with considerable strength, and now and again it bore past us a floe alive with busy, chattering penguins.

Somewhat later Bernacchi and some others landed again to visit once more the grave of poor Hanson, and to see that all was well with it. They took with them a tin cylinder containing the latest information with regard to our voyage, with directions to place it in some conspicuous part of the hut. The following year this cylinder was found by the 'Morning,' and gave the first information that the 'Discovery had succeeded in reaching these southern regions.

At 3 A.M. on January 10, when it was still gloriously calm and bright, we weighed our anchor and again stood out to sea, steering close around the high land of Cape Adare in hopes of finding a clear channel close to the land. At first it appeared as though we should do so, but soon the tidal stream began to make from the south, and the whole aspect of the streams of heavy pack-ice rapidly changed; before we could decide to turn, the pack was all about us, and we were being rapidly borne along with it. Across the entrance to the bay there was a chain of grounded icebergs, and it was towards these that we were now being carried; we could see and almost hear the heavy floes grinding and overriding one another against these barriers. For the first time we faced the dangers of the pack, and became aware of its mighty powers. For

we could do little or nothing, the floes around us were heavier than anything we had yet met; twist and turn as we would, we could make no appreciable advance, and in front of one monster floe we were brought to a standstill for nearly half an hour. Still we battled on; Armitage remained aloft working the ship with admirable patience, the engine-room, as usual, responded nobly to the call for more steam, and soon the 'Discovery' was exerting all her powers in the fray, but the progress was still so slow that it looked almost inevitable that we should be carried down amongst the bergs. It was one of those hours which impress themselves for ever on the memory. Above us the sun shone in a cloudless sky, its rays were reflected from a myriad points of the glistening pack; behind us lay the lofty snow-clad mountains, the brown sun-kissed cliffs of the cape and the placid glassy waters of the bay; the air about us was almost breathlessly still; crisp, clear and sun-lit, it seemed an atmosphere in which all Nature should rejoice; the silence was broken only by the deep panting of our engines and the slow, measured hush of the grinding floes; yet, beneath all ran this mighty, relentless tide, bearing us on to possible destruction. It seemed desperately unreal that danger could exist in the midst of so fair a scene, and as one paced to and fro on the few feet of throbbing plank that constituted our bridge, it was difficult to persuade oneself that we were so completely impotent. It is curious here to note that, except myself, only those who were actually on watch were on deck. The hour was early, and the majority were resting after their labours of the previous night, and so, asleep in their bunks below, they were happily unconscious of the uncomfortable possibilities before them; and that they were not told bears testimony to the fact that a fuss was rarely made in the 'Discovery' unless there was some good reason. Our release from this danger was so gradual that it would have

been difficult to say when it happened; perhaps on these occasions one is always a little slow to realise that things are getting better. It came from the gradual weakening of the tide, and most unexpectedly, because we had not looked for change in this for some hours to come. But gradually the tidal stream slackened, the close-locked floes fell slightly apart, and under her full head of steam the 'Discovery' began to forge ahead towards the open sea and safety. By 8.20 we had won through, and could breathe a sigh of relief. For me the lesson had been a sharp and, I have no doubt, a salutary one; we were here to fight the elements with their icy weapons, and once and for all this taught me not to undervalue the enemy.

During the forenoon we were able to stand within seven or eight miles of the high bold coastline to the south of Cape Adare, but later we were obliged to turn outwards to avoid the heavy streams of pack-ice drifting along the land, and this took us well outside the group of rocky islets on which Ross landed, and which he named the Possession Islands. Our navigator took advantage of fine weather to swing the ship; this means that the ship was gradually turned round, and as her head pointed in certain directions, observations of the sun were taken from which the error of the compass could be computed. I have already explained how highly important the finding of the compass errors at various places was, but it should be added that since the error in any spot might differ according to the direction of the ship's head, it was also necessary that an allowance should be made for the particular direction of the ship's head when an observation was made. It was to obtain this allowance that the 'Discovery' was swung, and therein we held an immense advantage over Sir James Ross, who had been unable to manœuvre his sailing-ships in this manner; but although we realised the advantage of swinging, it involved not a few trials and tribulations: sometimes when we had

stopped for this work, clouds would come flying across the face of the sun, and we had to wait patiently until they had passed; at others, the wind would spring up and make the ship so difficult to handle that it was some time before we could get her steadied on the various courses; and as these delays tended to fritter away the valuable hours of our open season, it can be imagined that we did not regard them with complacency.

Owing to our being continually forced to edge out to seaward to avoid streams of pack, by the morning of the 11th we were well clear of the land, which, however, could be very distinctly seen in the distance, and gave us much to think and talk about as we recognised the various peaks and headlands which Sir James Ross had named.

We still stood to the south, but our progress was slow owing to a brisk S.E. wind, and to the fact that we were only using one boiler. As I have pointed out, of all economies practised on board, the most important was that of coal, and every device by which a saving could be effected in this respect was worthy of consideration. It is still doubtful, however, whether my decision to use one boiler commonly, instead of two, really effected the saving I intended. At this time the 'Discovery,' with both boilers alight, would burn from five to six tons of coal a day, and for this she could maintain a speed of six or seven knots in calm water; with one boiler, she would burn from three and a half to four tons, productive of a speed of four to five knots in calm water. So far the problem, though not very exact, is capable of solution; but the trouble is that a calm sea is a rarity, and the 'Discovery' was so dependent on wind and sea that when these conditions were included, the question was complicated out of all recognition. The problem as to whether the ground could more economically be got over with one boiler or two was therefore one that could only be decided by experience. At this time we had no experience

to guide us; for good or ill I decided on using the single boiler, and with rare exceptions this became our custom throughout the summer cruise.

On such occasions as the present, however, it meant that our progress against an adverse wind was exceedingly slow. On the 11th we only made fifty-five miles, and on the 12th only thirty-two miles, on our southerly course. The wind gradually increased, and the weather became very unsettled. On the afternoon of the 11th we had a succession of snowstorms, and the land was blotted out in thick haze. During the misty evening we were surrounded by large flocks of Antarctic petrel, which stayed with us for a time, and vanished as suddenly as they had come. Almost immediately after we were surrounded with flocks of snow petrel, quaint little ghostly forms flitting about in the mist, and dropping now and again to the edge of a floe to capture the small *euphausia* on which they feed.

During the 12th we scarcely made any headway at all. The wind increased from the S.W., and occasionally bore down on us in heavy snow squalls. The low black rock and bold capes of the coastline stood out distinctly; but heavy, ominous clouds obscured the mountains. We could now distinguish Coulman Island on our bow, and by the morning we had brought it almost abeam; but by this time the weather bore a still more threatening aspect. A heavy swell came up from the south and the glass was falling. There could be little doubt that a gale was brewing, and in order that it should not carry us far to the north I thought it wise to try to seek shelter under Coulman Island. We turned in, and were soon amongst the loose pack-ice and in smoother water, but the wind was momentarily increasing, and we were obliged to light up our second boiler in order to gain the open-water shelter which we could now see under the high cliffs of the island.

Coulman Island, like all the coastal land, is a mass of volcanic rock, rising about 2,000 feet above the sea. It

is comparatively flat on the top, which is covered with an ice-cap of considerable thickness, and it is surrounded by steep and in some places almost vertical cliffs. Beneath the heaviest falls of névé from the ice-cap, and clinging to the steep cliffs, are fan-shaped masses of ice with vertical faces, rising as much as 100 feet above the sea. These have all the appearance of glacier tongues, though they can scarcely be called by that name, and they form an intermittent ice-foot fringing the coast. The land as we approached it looked illusively near; the sky was overcast, and the higher land was hidden in cloud, but beneath this sheet of grey the black rocks stood out with such distinctness that one was wholly deceived as to their distance. So strong was this deception that the engines were eased when we were nearly two miles from the cliffs, under the impression that they were only a few hundred yards away; we only discovered our mistake when we saw a colony of penguins, and found that even with glasses it was impossible to distinguish the individuals. I find also I noted in my diary that there was on our right 'a curious indentation like the crater of a volcano,' and this was really the strait between the island and the mainland, some ten miles across.

Afterwards in our winter quarters, and during our sledge journeys, we got to know very well how easily one could be deluded in respect to distance, and what extraordinarily false appearances distant objects would assume. The matter is of more than passing interest, because it shows that one must be exceedingly cautious in believing even what appears to be the evidence of one's own eyes, and it largely helps to explain some errors which we found had been made by former explorers, and which we knew must have been made in all good faith.

During the night of the 13th we lay under the shelter of the high cliffs on the N.E. side of Coulman Island, over which had now gathered a heavy storm cloud; the wind

had risen to a full gale at sea, but only reached us in occasional squalls which swept down from the high cliffs. To occupy our time, a trawl-net was put over in about 100 fathoms of water, and great was the delight of Mr. Hodgson when it was found to be well filled with specimens. At such times our biologist was in his element; on one side of him would be arrayed a number of glass jars, before him would lie in one mass the mud, stones, and animals which the net had produced. And thus, surrounded by a circle of eager, curious faces, he would work with fingers and forceps, sorting fish, sponges, crustaceans, and polyzoa into their proper receptacles. It was as much as anyone's life was worth to approach without invitation, but questions were allowed and would be answered, generally with a string of lengthy scientific terms which left the questioner about where he was before.

By the morning of the 14th the wind had increased to a furious gale, and the squalls now swept down over the cliffs with such terrific violence that we were forced to exert all our one-boiler power to keep the ship in her station, and even thus we began to lose ground. The ship would not face the wind directly, and we were obliged to carry it on the bow with the yards braced sharp up; in this position she would gradually edge away sideways until it became necessary to bring the wind on the other bow and edge back again. We had so little control over her that we could not alter our course by 'tacking,' but were obliged to set a head sail and so 'wear' round with our stern to the wind. In the afternoon the wind force, as measured by the Robertson anemometer, was ninety miles an hour, and as we continued to lose ground we got into a more choppy sea, which sent the spray over us in showers to freeze as it fell. As evening approached we drove down on a line of pack and amongst several small bergs, raising clouds of spray in the driving gale. Our situation was not pleasant; to avoid one berg we were

forced to go about, and in doing so we ran foul of another. As we came down on it our bowsprit just swept clear of its pinnacled sides, and we took the shock broad on our bows: it sent us reeling round, but luckily on the right tack to avoid further complications, and we rebounded clear of our dangerous neighbour. The night which followed was dismal enough; again and again small bergs appeared through the blinding spray and drift, and it was only with great difficulty that our unmanageable ship could be brought to clear them. Meanwhile, in spite of our continuous steaming, we were being driven farther and farther to leeward. But even gales must have an end, and towards morning there was a visible moderation in the wind, when we were able to creep up towards the island once more. In the afternoon an arch of clear sky appeared in the south and the wind fell rapidly. We were able to steam up close to the island once more; and there, between two high tongues of ice off Cape Wadworth, we landed on the steep rocks and erected a staff bearing a tin cylinder with a further record of our voyage.

By the time this was accomplished the wind had fallen completely, and the sun shone forth with great brilliancy. We entered the strait between the island and the mainland and found it to be considerably narrower than was expected, so that we soon approached the high land of Cape Jones on the other side. At this time, although there was a quantity of pack in the southern limits of the strait, from our crow's-nest it looked as if it would not be difficult to find clear leads to the open sea beyond, and thus to pass completely through the strait, but when we attempted this some hours later we found the pack closely locked in the entrance.

To the southward of Cape Jones the land recedes abruptly and sweeps round, forming a long bay, behind which we now saw rising in a clear sky the magnificent sharp peaks of Mounts Monteagle and Herschel, and the

high snow-covered ranges between. From the summits many vast glaciers sweep down with majestic curves to the sea, and on these we looked with a keen eye, calculating the chances of reaching the interior over surfaces which looked so smooth at this distance. But the most remarkable physical feature of this neighbourhood is the fact that the whole of this bay, called by Mr. Borchgrevink 'Lady Newnes Bay,' is filled with a vast mass of what we subsequently came to call 'barrier' ice, a sheet of such thickness that its towering ice-cliffs stand in many places 150 feet above the water. On the origin and nature of these extraordinary ice-formations I shall have more to say in a future chapter. At this time, although few of us had much knowledge of ice-conditions in other parts of the world, we felt that we were gazing on a phenomenon unlike anything reported elsewhere.

On our passage across the strait we had a very remarkable instance of the influence of volcanic rock on the compass. Two successive bearings taken of a distant cape showed us that the card had swung 8°. At this time we were more than a mile from the cliffs of the island, and on sounding found forty fathoms of water beneath us. The directive force of the compass was of course extremely small, but such a large deflection is astonishing.

In the evening we entered a long inlet between Cape Jones and the barrier-ice, and later turned out of this into a smaller inlet in the barrier-ice itself. After pushing through heavy detached floes we secured to some sea-ice which, although cracked in all directions, had not yet broken away. We were now in a remarkably well-sheltered spot; on each side we had high ice-cliffs, whilst across the mouth of the inlet lay the high land of Cape Jones. On the sea-ice of the inlet, which ran for some distance ahead of the ship, more than a hundred seals lay basking in the sun, and elsewhere a small colony of Emperor penguins in process of moulting exhibited

the most dishevelled appearance, and evidently hated to be seen with their usually smooth glossy plumage in such an untidy state.

As so often in the Antarctic Regions, we resolved to turn night into day, and, although it was 10 P.M., to start about our work at once. Our work was not a pleasant task, but one we regarded as very necessary—namely, that of adding to our larder sundry joints of seal. We felt fairly confident of finding a wintering spot before the season closed, but we had no guarantee that we should find seals in its vicinity, and it seemed the wisest plan to get them whilst we could.

The seal possesses the most astonishing vitality, and though nothing can be easier than to catch and wound these poor creatures, it is difficult to kill them outright, and until our men had had practice and knew exactly where to strike, many a futile knife-thrust was given.

It seemed a terrible desecration to come to this quiet spot only to murder its innocent inhabitants and stain the white snow with blood; but necessities are often hideous, and man must live. Some of us were glad enough to get away on our ski and to climb the steep snow slopes at the end of our creek. We found that the surface of this 'barrier' mass undulated in long waves, some of which we crossed; but knowing we had no prospect of reaching the land, we soon turned and employed ourselves in sliding down the steep slopes of the inlet on our ski, an amusement which cost us many falls.

Leaving the men to get in the seal carcases and some ice for our boilers, I turned in at two to get a few hours' rest before we again put to sea. On returning to the deck at 7.30 I was told that all work was completed, but that some five hours before a party consisting of Dr. Wilson, Mr. Ferrar, Cross and Weller had got adrift on a floe, and that no one had thought of picking them up. Although the sun had been shining brightly all night, the

temperature had been down to 18°, and afar off I could see four disconsolate figures tramping about to keep themselves warm on a detached floe not more than fifteen yards across. When at length our wanderers scrambled over the side, it was very evident they had a big grievance, and it was only after some hot cocoa that they could talk of their experiences with ease. They had been obliged to keep constantly on the move, and when they thought of smoking to relieve the monotony of the situation, the smokers found they had pipes and tobacco, but no match. It was whilst they were dismally discussing this fact that Dr. Wilson, a non-smoker, came nobly to the rescue and succeeded in producing fire with a small pocket magnifying glass—a fact which shows not only the resource of the officer, but the power of the midnight sun in these latitudes.

As we turned the corner of the barrier-ice cliff I saw to my disgust that the channels of open water which I had observed to the south on the previous evening had now closed up, and only thick pack lay in that direction. There was nothing for it but to pass again round the north side of Coulman Island, which, owing to many buffetings with loose pack, it took us the whole day to circumnavigate.

On the 17th we had to stand out farther and farther from the land to clear the pack; on our return voyage we also found much pack in this vicinity, and it is evident that Coulman Island forms a sort of *cul-de-sac*, delaying the ice as it passes up the coast.

It was not easy under our varying conditions to arrive at the currents along this coast. We found that there was evidently a tidal stream setting alternately north and south. Whilst we were delayed under Coulman Island we had been influenced by this fact, and had on occasions seen small bergs travelling against the wind; a change of direction in the stream had appeared to us

to occur only once in twelve hours, and this was supported by subsequent tidal observations.

It is probable that the north-running stream is stronger than the south, as undoubtedly the bergs as well as the pack-ice move gradually to the north. The pack-ice is of course mostly influenced by the wind, which at this season of the year appears to blow pretty constantly from a southerly direction.

At 2.30 A.M. on the 18th we arrived in the entrance to Wood Bay, only to find it heavily packed. I had hoped to be able to land here and leave a record, but to have attempted to force through this heavy ice would have involved an unjustifiable expenditure of coal. The ice we faced was evidently that which had been formed in the bay; it was from six to seven feet thick, and far more solid than anything we had yet encountered. Very little snow had fallen on the surface of the floes, and except where some volcanic sand and rubble had been carried on to them by the wind, there was no sign of decay. To run into floes of this description was a very different matter to charging the comparatively rotten ice which we had met in the pack.

Away to the N. and N.W. of us we could now see the sharp peaks of Monteagle and Murchison, amongst bewildering clusters of lesser summits; across the bay rose the magnificent bare cliff of Cape Sibbald, rising 2,000 feet above the sea; to the west one could trace the breaks in hill-outline suggestive of the windings of the arms of the bay and the glacier valleys beyond, but the eye lingered most pleasantly on the uniform outline of Mount Melbourne to the S.W. This fine mountain rears an almost perfect volcanic cone to a height of 9,000 feet, and, standing alone with no competing height to take from its grandeur, it constitutes the most magnificent landmark on the coast. Cape Washington, a bold, sharp headland, projects from the foot of the mountain on its

eastern side, and finding such heavy pack in Wood Bay, we now turned to the south to pass around this cape.

From this point our voyage promised to be increasingly interesting, since the coast to the south of Cape Washington was practically unknown. Ross seems to have satisfied himself that there was a continuance of land to Mount Erebus, but he saw it only at a very great distance—a fact which is attested by the absence of names from individual mountains and capes. He probably did not see more than the dim outline of hills far beyond his horizon, and the only particular name he supplies—that of Cape Gauss—was probably given to some darker patch of bare mountain-side, as at this spot there is no such conspicuous cape as he imagined. I have already pointed out how easily one may be deceived in such a matter, and it can be imagined that we looked forward eagerly to exploring this unknown land.

As we passed within half a mile of the sheer headland of Washington we were surprised to get shallow soundings. Our lead gave us eighteen fathoms, then fifteen, then eight, and in this shallow water our compass was again largely disturbed.

It should be understood that we were now south of the magnetic pole, and as the south-seeking end of our compass needle continued to point towards that spot, our ship's head, although directed to the true south, appeared by the compass to be travelling in a northerly direction. To find out the actual amount of this error in different places was, of course, one of our most important missions, but throughout our voyages in these seas, where the error was so great and so constantly changing, the compass proved a most confusing instrument, and in thick weather much calculation was necessary to determine the true direction in which any new course would take one.

On rounding Cape Washington we were delighted to

find that the coast was comparatively free of pack. We could now see that the western slopes of Melbourne merged into a range of comparatively low hills, which continued to the south till they rose to the steep sides of a long, high table mountain beyond which a snow-covered ridge carried the outline to farther mountains of a less perfect but distinctly tabular form. We were destined to find this tabular form of mountain to be a feature of Victoria Land for many hundreds of miles to the south, and largely a key to the geological formation of the whole country; but at this time the majority of us failed to appreciate the importance of this new development, though we were aware of the novelty of outline.

The coastline from Cape Washington sweeps back in a deep bay, and then runs directly to the south, in places fringed by a steep ice-foot, while in others bare, rocky slopes descend to the water's edge. Curiously enough, there was but little snow on the higher mountains, but the foot-hills in front were almost covered with a thick glacial crust.

As we got to the southward of our table mountain we could see that the high snow ridge beyond it represented an immense overflow of the ice-mass of the interior. Some vast store of ice beyond seemed to take advantage of the break in the mountain chain, and to pour down in one great river of ice to the sea.

The glistening white surface of this great overflow, fully fifteen miles across, rose gradually to a height of some 4,000 feet at the crest of the ridge, and no doubt continued to rise to greater height beyond. It was broken only in the centre, where a huge beehive-shaped *nunatak* thrust its head through the mass and left deep furrows in its snowy surface. The rich brown of the bare basaltic rock of this *nunatak* is conspicuously contrasted with the vast surface of white snow about it, and therefore constitutes one of the most striking landmarks on the coast, a most remarkable and distinctive feature.

And now as we skirted the ice-foot on our right we found ourselves suddenly brought up in a curious inlet, with ice-walls on every side, and were obliged to turn and retrace our steps for some way, when, still keeping the ice-wall on our right, we found ourselves going due east directly away from the land. For many hours we steamed along this ice-cliff, which varied in height from 70 to 100 feet, until, after travelling more than twenty miles, we came where the cliff rose to 150 feet in height and turned abruptly to the south, and after a mile or more again abruptly to the west. We now perceived that we had encountered another example of the barrier-ice which we had seen in Lady Newnes Bay, but this time the ice ran out in a long snout to seaward, and we could fit no theory to the fact that the extremity of the snout was higher than many parts behind it. Off the end of the snout we obtained 368 fathoms of water—another rather puzzling circumstance, when the flotation of ice was considered.

On turning the corner to the south we were again brought in full view of our ancient enemy the pack-ice. Here, as further north, it is evidently detained in its passage along the coast. The extent of the pack carried us some way to the south before we could find a 'lead' towards the land. It was a gloriously bright Sunday morning—so clear that at midday we sighted Mount Erebus at a distance of 120 miles, and in the afternoon could even see the vapour rising from the summit of that lofty volcano. The day was so perfectly clear that at one time we could see Melbourne, Monteagle, and even Coulman Island to the north, and Erebus to the south; that is an included range of vision of 240 geographical miles.

It is here that I find a note in my diary to the effect that the ice-cap of the interior appeared to rise beyond the coastal mountains, and that patches of rock could be seen farther inland, but that it was impossible, owing to

the mirage, to define the height or distance of such patches. This note is of great importance in connection with our subsequent exploration of the interior ice. At 6 P.M. we were able to turn towards the land, and later in the night made out a very conspicuous bluff cliff in marked contrast to the white snow slopes behind.

We were now in a latitude where it was most desirable that we should make a diligent search for safe winter quarters for the ship. Wood Bay had been thought by many in England to be the most southerly spot in which we were likely to find security, but we had seen enough of the coastline to the south of that place to realise the impossibility of travelling along it in sledges, and to assure us that if we wished to make any advance to the south we must find a harbour in some higher latitude. The sight of this bluff cliff seemed to give promise of finding an inlet in its neighbourhood, and I decided to make an effort to explore the coast. But to approach the land was not such easy work, as we had constantly to force our way through streams of pack-ice, and the floes were more solid than any we had yet met. If one charged them with any speed the shock of meeting was tremendous; the ship would stop dead with masts and yards quivering, anyone below might have imagined an earthquake, and to be in the swaying, trembling crow's-nest on such an occasion was anything but a pleasant sensation. The only comfortable way was to push quietly through, and so it was not until 4 P.M. on the 20th that we could convince ourselves that we had been right in expecting an inlet behind the conspicuous mass of rock for which we had been steering. An hour later, as we entered it, we met ice which had evidently been formed inside and but recently broken up. It was perfectly smooth, showing absolutely no sign of pressure, and therefore indicating what a secure wintering harbour the inlet would make. But what struck us as most curious

was that every floe was a rectangle and looked as though it had been purposely shaped with accuracy and precision; it is difficult to comprehend how an irregular ice-sheet can be broken naturally in this manner; the swell which breaks it must be extremely regular, and the ice-sheet must be astonishingly uniform. One must infer also that very placid conditions exist in this well-sheltered inlet both in winter and spring.

As we gradually worked our way into the inlet we could see on our right a few small crevassed glaciers between high cliffs showing faulted rock strata, of which our geologist at this time could make little. On the left and nearer shore the steep slopes were formed of broken angular boulders, with here and there the native rock peeping through. Two or three miles ahead the inlet took a sharp turn to the left. As no boat could be used in such an ice-strewn bay, we were forced to reach the shore by other means, and a large party was soon bounding from floe to floe, now and then encountering a breach too wide to be leaped and having to raft themselves across.

On shore we found that the boulders which had looked so dingy from the ship were mostly composed of granite, and a little chipping provided us with such a variety of this beautiful crystalline rock that we afterwards named the inlet Granite Harbour. Ice scratchings were visible on a few of the boulders, but much weathering had taken place.

Enclosed by so much bare rock capable of absorbing the sun's rays, and well protected from the wind, this inlet is probably the most sheltered spot in many a league of coastline, and in this calm, bright weather we thoroughly enjoyed our run on shore, and, except for the ice in the bay, could have imagined ourselves in a far milder climate. We found small streams of water meandering over the stones, and it was pleasant to hear their music

and to drink the pure snow water, and still pleasanter to find in their sheltered courses small banks of moss of almost luxuriant growth. We headed up the bay to see where the inlet ended after its sharp turn, and disturbed several skuas guarding their fluffy slate-coloured chicks. They showed their annoyance by wheeling round and swooping down straight at us, only turning their course at the very last moment, so that one was sometimes brushed by their wings as they swept past with wild cries. The skua is a heavy bird with a very formidable bill, and such attacks appear alarming, as doubtless they are intended to do; but though we often saw them under similar conditions, I do not think anyone was ever actually struck.

After scrambling over rocks for some time, we reached the corner from which we could see the extremity of the inlet, where the snout of a glacier of no great size dipped into the sea. We saw at once that the inner recesses of this inlet would have afforded us excellent shelter for the winter. In a week or two the ice would have pushed out to sea, leaving a free surface on the placid waters of the bay. Around the second corner the sea swell had fallen to a small rhythmic movement which could have caused little inconvenience. The steep shores around were skirted everywhere with a low strip of fast ice on which it would have been easy for us to land, and across which we could have carried the heavy materials for constructing our huts. Here and there on this ice-foot lay a somnolent seal, giving assurance of winter food; and although the waters of the inlet were doubtless very deep, as they are in most fiords, it is probable that in the vicinity of the glacier we should have found some bank of morainic material on which we could have cast our anchors; in fact, altogether there was a promise of snugness and security about this spot which we met nowhere else.

It is only on looking back on our experiences that I can

see how much we should have missed had we succumbed to the allurements of this tempting spot. Surrounded as we should have been by steep and lofty hills, we could have obtained only the most local records of climatic conditions, and our meteorological observations would have been comparatively valueless; but the greatest drawback would have been that we should be completely cut off from travelling over the sea-ice beyond the mouth of our harbour. There can be no doubt that the sea-ice was constantly broken up along this coast in the winter of 1902, and an attempt to travel to the south along the coast without the assistance of the sea-ice would have been beset with such innumerable dangers and difficulties that it is possible we should never have reached even as far south as the spot at which we eventually wintered. It is when one remembers how naturally a decision to return to this place might have been made that one sees how easily the results of the expedition might have been missed.

When, after a stiff climb, we again came abreast of the ship, we found the swell had increased, and it was only with some difficulty that we regained the ship over the swaying floes. Shortly after midnight we pushed out to sea, satisfied that we had discovered a place which would serve us for wintering in default of a better.

Turning again to the south, we found an open sea, and crossed the 77th parallel; but early on the 21st the inevitable pack appeared ahead, and we were forced away from the coast in trying to pick the easiest channels. The ice we met with at first was not formidable, but in the afternoon we entered a pack of the hard solid ice which we were now getting to know so well and to associate with the inlets on the coast. The moment of entering this pack could be detected exactly from the astonishing increase in the shocks sustained by the ship.

At this time I still cherished a hope of being able to

find more southerly winter quarters than Granite Harbour, and, searching the coastline with powerful glasses, thought I could detect the promise of such on our starboard bow, and so spent some hours in trying to push through the heavy obstruction that now met us. By 4 P.M., however, as we had progressed only a few hundred yards, we edged away to the eastward, where things appeared more promising; here we got into ice which looked much heavier, as it was thickly covered with snow, whereas the ice which we had been attacking was practically bare and blue. The line of demarcation was well defined, and the difference in the nature of the ice was felt the moment we crossed it—the heavy shocks ceased and the ship was able to make gradual though slow progress.

I have dwelt somewhat fully on the nature of the pack-ice through which we passed at various times, because the differences are so great, and because the subject is not only of great interest but of vast importance to the navigator in these seas. It was always a fascinating study to observe the pack-ice, to infer the various conditions under which the ice had been produced, and to note the extraordinary differences of form that frozen sea-water can assume.

The night of the 21st was gloriously fine. By 8 A.M. we were in the middle of McMurdo Sound, creeping slowly, very slowly, through the pack-ice, which appeared from the crow's-nest to extend indefinitely ahead. But a few miles separated us from the spot where we were ultimately to take up our winter quarters, and as we got to know this scene so well it is interesting to recall some extracts from what I wrote when first we gazed on it: 'To the right is a lofty range of mountains with one very high peak far inland, and to the south a peculiar conical mountain, seemingly ending the coastline in this direction; on the left is Mount Erebus, its foothills, and a glimpse of

Mount Terror. The Parry Mountains cannot be seen ahead of us. In the far distance there is a small patch like a distant island. Ross could not have seen these patches, and a remnant of hope remains that we are heading for a strait, and not a bay.'

This was written shortly after four, and at eight I added: . . . as we drove slowly southward the apparent islands ahead broadened out, and there was no longer a doubt as to their being connected to form the end of the bay. But it is highly satisfactory to note that there are no mountains in the background, and that so far as the eye can see there must be a plain stretching directly south. . . . We now see that if fortune allows us to winter in either of the two harbours we have found, we shall have good prospect of getting to the south. . . . In this manner the coastline to the south for nearly 40° of arc is suggested by five dark rock patches and their connecting snow slopes, this space being flanked on the right by the conical hill and on the left by a spur of Erebus, which appears to form a sharp headland.' It was easy afterwards to recognise each point here noticed when, actually situated at the 'spur of Erebus,' we named the conical mountain after our ship, and the high western mountains in honour of the Royal Society; but it is curious to think that at this time I should have been prepared to affirm that continuous land ran from Erebus to the mainland.

So at 8 P.M. on the 21st we thought we knew as much of this region as our heavy expenditure of coal in the pack-ice would justify us in finding out, and as before us lay the great unsolved problem of the barrier and of what lay beyond it, we turned our course with the cry of Eastward ho!

CHAPTER V

ALONG THE GREAT BARRIER

Strange Footprints—Landing under Mount Terror—The Last Record Left—Along the Great Barrier—New Land—Foggy Weather—Surrounded by Bergs—We Lose our Bearings—Decision to Turn Back—Good View of King Edward's Land—Landing on the Barrier—Balloon Ascent—Return to Victoria Land.

> She skirts the icy margin of the main,
> And where unchanging from the first of time
> Snows swell on snows amazing to the sky,
> And icy mountains high on mountains pil'd
> Seem to the shivering sailor from afar
> Shapeless and white, an atmosphere of cloud.—THOMSON.

IN our journey from Cape Washington to the south we had already done something to justify the despatch of the expedition.

A coastline which had hitherto been seen only at a great distance, and reported so indefinitely as to leave doubts in many minds with regard to its continuity, had been resolved into a concrete chain of mountains; the positions and forms of individual heights, with the curious ice formations and the general line of the coast, had been observed. The lofty peaks of Northern Victoria Land had been seen to be succeeded by a comparatively low mountainous country of peculiarly suggestive topographical outline, behind which a vast interior ice-cap appeared to rise to greater heights. Toward the 78th

parallel the flanking ranges of the continent again rose to great altitudes, and yet farther south we could see no tendency in them to turn towards the east as had been supposed.

In all this we had been aided by the most astonishingly fine weather; instead of the gales, thick weather, and snowstorms which we had expected, since the heavy weather off Coulman Island, we had daily enjoyed bright sunshine, cloudless skies, and calm seas. We could but hope such good fortune would continue on our journey to the eastward.

As we turned on the night of the 21st to push our way to the open sea once more, we had a rather curious and exciting adventure. Owing to some inexplicable wounds found on the bodies of seals, it had been suggested that a land mammal might exist in these regions, though hitherto unseen by man. Most of us were incredulous of this theory, but on that night we suddenly came on a floe covered with soft snow which bore the impress of footprints wide apart and bearing every appearance of having been made by a large land animal. The excitement was great, and observers with cameras were soon over the side and breathlessly examining this strange spoor; but, alas! it was soon detected that the impress was that of a webbed foot, and gradually we came to the conclusion that the footprints were those of a large giant petrel, and that their distance apart was due to the fact that they had been made when the bird, half-flying and half-walking, had been lazily rising on the wing. Even the most imaginative had to concede that we had not increased the prospect of finding a Polar bear or any kindred animal in these inhospitable regions. Shortly after midnight we reached the open water and shaped our course to pass between Beaufort Island and the long snow capes of Erebus.

In the morning we stopped to sound and dredge in this

channel; we found a depth of 470 fathoms, but the fouling of our trawl rendered our catch of sea beasts somewhat disappointing.

The volcanoes of Erebus and Terror lie west and east, united by a high humped ridge; to the N.W. of Erebus extends the long and lofty Cape Bird, whilst to the N.E. of Terror, the slopes, blistered with innumerable volcanic cones, descend to the splendid basaltic cliffs of Cape Crozier.

The northern face of this land is heavily glaciated, masses of crevassed névé descending to the sea with a precipitous ice-foot, except on the northern and N.E. slopes of Terror, where the snow only occupies the deeper valleys, and where there are such extensive areas of bare land that it looks quite possible to ascend Mount Terror without encountering snow slopes. In this region the land has therefore a very dark appearance from the water's edge to the summit of Terror.

It was this northerly view of Erebus and Terror that Ross saw in his early voyages, and it is interesting to note that the sketches made at that time show no extent of bare land; moreover, Sir Joseph Hooker, the great survivor of that expedition, has told me he is almost certain that the slopes of Terror were covered with snow when he saw them. Can it be possible that the sheet of ice which exists elsewhere can have disappeared from this region within the comparatively short space of sixty years?

At 8 P.M. we arrived off the bare land to the westward of Cape Crozier, where the dark volcanic hillside reached the sea in gentle slopes; thousands of small Adélie penguins were passing to and fro on the shelving beach, hurrying up steep winding paths to their nests, or springing into the curling breakers to seek their food.

We thought at first it might prove impossible to land, owing to the northerly swell which broke high on the

rocky promontories, but immediately off the beach of the rookery lay a number of grounded bergs which promised to form some protection from the waves. One of our staunch whaleboats was soon lowered into the water, and, somewhat crowded with sixteen persons and a number of magnetic instruments, we pulled for the land. On nearing the shore we found that in spite of the icebergs the surf was considerable, and as we did not at all wish to be upset into this icy sea, we approached the beach with great caution. With our bows pointing to the shore we waited for a heavy wave, when a sharp order was followed by a strain on the oars, and we were carried to the beach on its crest; regardless of wet feet, all hands had then to leap out, and heaving lustily on the painter and thwarts we soon had the boat high and dry.

We proposed at this place to complete our chain of records, and had brought with us a post, a tin cylinder containing an account of our doings, and the necessary implements for erecting them. A spot was chosen in the centre of the penguin rookery on a small cliff overlooking the sea, and here our post was set up and firmly anchored with numerous boulders. In spite of all our efforts to mark the place at a few hundred yards it was almost impossible to distinguish it, and one could not help thinking that, should disaster come to the expedition, what a poor reed was this on which alone we could trust to afford our friends a clue to our whereabouts. Yet it was this small post on the side of a vast mountain, in the midst of the most extensive penguin rookery we had seen, that eventually brought the 'Morning' to our side.

Whilst Bernacchi and Barne set up their magnetic instruments and started on their chilly task of taking observations, we others set off in twos and threes to climb the hillside in various directions; it was long before we

could get clear of the innumerable penguin colonies and the all-pervading odour which they emit; and as they occupy every inch of available land, we found ourselves clambering up steep screes of loose stones, and climbing still steeper friable rock faces, getting what hold we could on the deeply weathered surface. With Royds and Wilson I at length reached the summit of the highest of the adjacent volcanic cones, for which our aneroids gave a height of 1,350 feet; there we were rewarded by a first view of the Great Ice Barrier. Perhaps of all the problems which lay before us in the south we were most keenly interested in solving the mysteries of this great ice-mass. Sixty years before Ross's triumphant voyage to the south had been abruptly terminated by a frowning cliff of ice, which he traced nearly 400 miles to the east; such a phenomenon was unique, and for sixty years it had been discussed and rediscussed, and many a theory had been built on the slender foundation of fact which alone the meagre information concerning it could afford. Now for the first time this extraordinary ice-formation was seen from above. The sea to the north lay clear and blue, save where it was dotted by snowy-white bergs; the barrier edge, in shadow, looked like a long narrowing black ribbon as it ran with slight windings to the eastern horizon. South of this line, to the S.E. of our position, a vast plain extended indefinitely, whilst faint shadows on its blue-grey surface seemed to indicate some slight inequality in level; further yet to the south the sun faced us, and the plain was lost in the glitter of its reflection. It was an impressive sight, and the very vastness of what lay at our feet seemed to add to our sense of its mystery.

But there was now 16° of frost, the chill air soon counteracted the warmth generated by our climb, and we were glad to be again on the move. As we stumbled down the steep inclines of the penguin rookery the astonished chicks ran helter-skelter in all directions; following blindly the

direction in which their beaks were pointing they frequently collided with each other and ran full tilt into our legs. It was often difficult to avoid treading on them; but as the chicks scattered, the old birds raised their ruffs in anger, and, quite devoid of fear, rushed at us with hoarse cries of rage. After beating wildly at our shins with their beaks and flippers they would fall back growling and cursing in the most abominable manner. Shortly after we regained the beach our magnetic observers completed their task, and when they had taken a short run to rouse up their chilled circulation we all assembled to launch the boat.

This did not prove by any means an easy matter. Awaiting our opportunity, we rushed her down on a receding wave, and up to our knees in water we endeavoured to launch her clear of the surf and at the same time to spring on board; but the next wave caught our stern, and in a moment we were broadside on and in imminent risk of being swamped. It was an occasion which called for instant action, and when it was good to have a boat manned by sailors. At the critical moment Mr. Barne leapt over the side and seized the stern of the boat, and his example was instantly followed by two or three of the sailors; and though the next curling wave swept over these devoted people, the boat luckily met it stern on and was poled out to sea as it receded. It was not a time when one would willingly take a bath, and our wet companions were glad to seize the oars and pull as hard as they could towards the ship; but by this time Mr. Armitage, in swinging the ship, had been carried some way to the west, so that when we got on board, teeth were chattering and hot cocoa or grog was felt to be very desirable.

From Cape Crozier the land turns sharply to the south in a magnificent black volcanic cliff in parts 700 or 800 feet sheer above the sea. The barrier edge extends at

right angles from the southern end of the cliff, and at first has a very rugged appearance where the ice-mass presses past the land, but within a few miles it settles down into its uniform wall-like aspect.

Early on the 23rd we started to steam along this long ice-face, hoping that fortune would favour us in discovering more facts concerning it, and especially in finding out what lay at its eastern extremity. In order that nothing important should be missed, it was arranged that the ship should continue to skirt close to the ice-cliff; that the officers of the watch should repeatedly observe and record its height, and that thrice in the twenty-four hours the ship should be stopped and a sounding taken. In this manner, during the following days, we were able to make a comparatively accurate survey of this northern limit of the barrier, and the result is indicated on the chart.

On the morning of the 23rd we found that the barrier edge did not exceed sixty or seventy feet in height, and though the weather was slightly overcast we could see for a long distance over the ice to the S.W. from our crow's-nest. It was on looking in this direction, but from a greater distance, that Ross thought he distinctly saw a high range of mountains running to the south from Mount Terror. He described them as 'probably higher than anything we have yet seen,' and named them the Parry Mountains. It will be remembered that when in McMurdo Sound I had some doubt as to these mountains, and it is therefore of interest to note the entry made in my diary on this occasion:

'Over the barrier and to the S.W. could be seen some small or apparently small hills, showing bare rock patches, but nothing could be seen of the Parry Mountains, and judging by our position two days ago we seem to have been viewing the hills which form or are close to the limits of McMurdo Bay. . . . The southern slope of Erebus

can be distinctly seen. . . . There seems every probability of getting over this slope on to the ice-plain if we winter west.'

Already there was a strong case against the Parry Mountains, and later we knew with absolute certainty that they did not exist; it is difficult to understand what can have led such a cautious and trustworthy observer as Ross to make such an error. I am inclined to think that in exaggerating the height of the barrier in this region, he was led to suppose that anything seen over it at a distance must necessarily be of very great altitude; but, whatever the cause, the fact shows again how deceptive appearances may be and how easily errors may arise. In fact, as I have said before, one cannot always afford to trust the evidence of one's own eyes.

On steaming along the barrier, we soon found that Ross had exaggerated not only its height, but its uniformity. This was perhaps natural, as in a sailing ship he dared not approach too closely, and often had to estimate the height when at a great distance; and the want of uniformity can only be determined by close measurement. It can be readily imagined that even if the height changes from 70 to 240 feet in ten miles, the change is so gradual that it cannot be detected by the eye at a distance, as the higher part will only appear to be closer. The only way in which the inequality can be detected is to follow the wall closely, when the change of height must be obvious. Ross had to judge his barrier from the very few places in which he was able to approach it closely.

Though we started with a long stretch of barrier not more than 70 feet high, by the evening of the 23rd it had risen to 240 feet. During the night the wind came off the barrier, and the temperature fell to 10°; shortly after, it again came from the sea, and the temperature rose to 25°. Later, this change of temperature with a shift

of wind became still more marked, and already we began to wonder what that great snow plain would be like in winter if it produced this great fall in the warmer summer air. Up to this time our clothing had been little out of the ordinary, but we now found that standing about on the bridge or sitting in the crow's-nest was chilly work, and warmer garments were dug out of our various drawers and lockers.

Though we were several days steaming along this ice-wall, the passage was by no means monotonous. Every few hours some new variation showed itself: now a sharp inlet or other irregularity of outline, now a more than ordinary alteration in height, now a change in appearance showing a difference in the length of time that the ice-face had been exposed; and throughout we could watch the gradual shoaling or deepening of the sea-floor as shown by the sounding machine. My diary is principally devoted to figures giving the definite data concerning these matters; but a few more general extracts may serve to give an idea of our progress along the ice-wall from day to day:

'*January* 24.—Barrier fell from 240 feet to 80, and later to 50, but gradually rose again in the evening to 90. Soundings both over and under 400 fathoms. Barrier sometimes very broken and rugged in outline. Passed some bergs and sharp inlets. Noon, long. 176.45 E., progress 86½ miles. In evening weather became overcast with snow.'

'*January* 25.—Barrier fell in night to 30, gradually rose to 80 feet, when there was a sudden dip for 200 yards to 15 feet. In afternoon irregular rise to 100 feet at midnight. Put sail on the ship in morning watch, but, wind hauling ahead, obliged to clew up. Passed over fifty icebergs in course of the day, the first we have seen since leaving Cape Crozier. They were mostly irregular in shape, but two, close to the barrier, had

evidently recently *calved* off that mass; the line of separation was very regular and even, and the bergs floated in precisely the same manner as they had when they formed part of the ice-sheet. Noon, long. 184 E., progress 91 miles. Evening, appear to be passing inside a very large berg detached from the barrier. Sounding 350 to 300 fathoms.'

'*January* 26.—The iceberg on the port bow turned out to be attached to the barrier; we appeared to be steaming through a long channel until 5 A.M., when we found ourselves at the head of an inlet. The ice on our right-hand side gradually sloped down from 120 feet to 20 feet at the extremity of the inlet; here it suddenly dropped to 8 feet, and on our left very gradually rose again to 90 feet. Our sounding here was 315 fathoms, and our lat. 78.36 S., the highest we have reached. The weather was very misty and overcast, and we could not see the ending of our channel until we were close on it. There was nothing to be done but to turn round and come out again, and on reaching the end of the ice-cliff, now on our right, we found a stiff E.N.E. breeze blowing, with a short sea causing the ship to pitch heavily. The temperature had risen to 31°. As we could not hope to make headway against this wind, we made plain sail on clearing the inlet, and allowing our steam to drop, we stood to sea close-hauled on the starboard tack. Later, the wind, which never blew above force 7, backed to the S.E., and not wishing to run too far from the barrier, we put about at 8 P.M. The glass, which has been low, is again rising.'

'*January* 27.—During the night the glass rose and the wind fell, and as we approached the barrier we put over our "Agassiz" trawl; the contents were not plentiful, but, I understand, contain several new species. In the afternoon we furled sails and steamed towards the barrier. When we started to steam along it, we were evidently

making little or no headway against a westerly set of at least three knots. Our very slow progress hitherto has been to a great extent due to an adverse current, which is much stronger at some times than at others: it is not improbable that there is a tidal effect which alternately accelerates and retards the current, but the net result is a strong set to the west. The present excessive force of the stream is probably due to the recent wind. We shall have to light up our second boiler. Along the barrier there is a heavy vapour rising from the water, and the water temperature has risen half a degree.

'Noon, long. 174.22 W.; negative progress for the day, and only a very few miles to the eastward of our position on the 25th. . . . Two whole days practically wasted; one requires a great deal of patience for this sort of work. Tried a new sounding tube, made with the object of getting mud from below the surface; the tube brought up a column of mud 18 inches in length, but there appeared to be no difference in consistency between the upper and lower layers.'

'*January* 28.—Passed abeam of the ice peninsula inside which we steamed on the night of the 25th. It rose from 90 to 150 feet, and soundings off its edge were all about 300 fathoms. About noon a lot of loose ice appeared ahead. It was found to consist of very low bergs and pieces of bergs, apparently broken from the barrier where it is quite low, and probably some way to the east, as the westerly drift is strong. We were obliged to stand some way off the barrier to avoid this ice, and at 4 P.M. a thick fog came down on us. In the evening the weather cleared, and we stood in towards the barrier again, passing a prominent ice peninsula with a cliff 200 feet in height. The barrier was again very irregular, and detached bergs could be seen in the various indents. Noon, long. 167.44 W. Progress, 80 miles. We are passing on slowly but surely to Ross's most easterly position.'

'*January* 29.—The barrier became very rugged and broken during the night, and soon after twelve it dropped to a few feet. We were running close to it in a fairly thick fog, but the speed was not great, and with a sharp look-out, the ice could be seen in good time. At 2.30 we ran into a small creek, only noticing our position by finding ice on both sides; that on the right was barely three or four feet above the water, sloping gradually up to 30 to 40 feet; that on the left was from 30 to 40 feet and sheer. The inlet was most irregular in shape, as, indeed, was the ice surface.

'This morning the low edge continued for several hours, and during the day we passed along a very smooth straight cliff of uniform height, and again, to our annoyance, found the current making to the west so strong that our progress was practically stopped until we could raise more steam. Soundings for day all about 360 fathoms. Noon, long. 162.6 W.; lat. 78.18 S. Passed a curious subsidence in the uniform ice-wall, where for some 300 yards there was a depression filled with hummocky ice.'

We had succeeded thus far in making a fairly complete investigation of the northern face of the barrier in spite of not a little thick and unpleasant weather, and, as will be gathered, we had found not only that it differed considerably from the rather uniform ice-wall which Ross had led us to expect, but that there were many puzzling features which seemed to increase rather than diminish as we approached its eastern extremity. It was not until later, when our positions were plotted, that we fully realised the significance of the fact that our course throughout had been to the southward of Ross's barrier, and that we had sailed continuously over ground which in his day had been covered with a solid ice-sheet.

What we thought of it all I do not propose to set down at present, but I hope that, having added other facts

which we were able to glean concerning it, I shall be able to throw some light at least on this very extraordinary ice formation.

By noon on this day, January 29, we had arrived at a particularly interesting place, as we were to the southward and eastward of the extreme position reached by Sir James Ross in 1842. From that extreme position he reported a strong appearance of land to the south-east, and in most minds there rested the conviction that land had actually been seen at that time. It was therefore with great curiosity that all eyes were directed over the icy cliffs to the south-east. The afternoon was bright and clear, and if Ross had seen land it must evidently be well within our view.

But alike from below and from aloft we could see nothing, and were obliged to conclude that the report was based on one of those strange optical illusions which are so common in this region, and against which, now more than ever, we were determined to guard ourselves.

In spite of our disappointment at being unable to report that Ross's 'appearance of land' rested on a solid foundation, as we steamed along this high ice-wall on the afternoon of the 29th we had an indescribable sense of impending change. The constant differences which we had observed in the barrier outline during the past twenty-four hours seemed to us to indicate strongly the proximity of land, though probably none of us could have produced a very tangible argument to support this view. We all felt that the plot was thickening, and we could not fail to be inspirited by the facts that we had not so far encountered the heavy pack-ice which Ross reported in this region, and that consequently we were now sailing in an open sea into an unknown world.

Many an eager face peered over the side; now and then a more imaginative individual would find some grand discovery in the cloud-forms that fringed the horizon, but

even as he reported it in excited tones his image would fade and he would be forced to sink again into crestfallen silence.

Meanwhile we were making comparatively rapid progress along the uniform high wall on our right. Perhaps the engines, as well as those in charge of them, were eager to find out what lay beyond. Our course lay well to the northward of east, and the change came at 8 P.M., when suddenly the ice-cliff turned to the east, and, becoming more and more irregular, continued in that direction for about five miles, when it again turned sharply to the north.

Into the deep bay thus formed we ran, and as we approached the ice which lay ahead and to the eastward of us we saw that it differed in character from anything we had yet seen. The ice-foot descended to varying heights of ten or twenty feet above the water, and behind it the snow surface rose in long undulating slopes to rounded ridges whose height we could only estimate. If any doubt remained in our minds that this was snow-covered land, a sounding of 100 fathoms quickly dispelled it. But what a land! On the swelling mounds of snow above us there was not one break, not a feature to give definition to the hazy outline. Instinctively one felt that such a scene as this was most perfectly devised to produce optical illusions in the explorer, and to cause those errors into which we had found even experienced persons to be led. What could be the height of that misty summit? And what the distance of that shadowy undulation? Instruments provided no answer—we could but guess; and although guesses gave an average height of 800 or 900 feet to the visible horizon, one would have been little surprised to learn that the reality was half or double that amount.

Around us were several icebergs grounded in the shallow sea; some lay on their sides, and in these for the first time we saw discoloured layers caused by embedded sand

and dirt. Our geologist departed in a boat to inspect these bands, whilst we lowered a small net and delighted the biologist's heart with a good haul from the sea-floor.

It was late at night before all was ready for proceeding, and by this time the eastern sky was banking up, and later the air was thick with falling snow. A sounding at 2 A.M. gave us the bottom at 265 fathoms, and at six the snow ceased and we could see a 200-foot ice-wall again with slopes estimated to rise to 500 feet behind. But an hour or more later, when all were once more astir for the day's work, a thick fog descended on us, blotting out for the time all hope of seeing what lay beyond the ice-foot.

Throughout the morning and afternoon of the 30th we continued to grope our way along, endeavouring to keep close to the ice masses on our right, whilst avoiding the deeper bays. Now and then the foggy curtain lifted slightly and revealed what lay within a mile or two of us, but beyond that all was tantalisingly obscure. Soundings were taken frequently, and, varying from 90 to 100 fathoms, showed that we were again in comparatively shallow water.

During the night the trend of the ice-foot had carried us due north, but in the morning we turned sharply to the east, and throughout the day seemed to be passing from cape to cape of a very indented coastline. When the fog allowed us to see them more clearly, we found that these capes were detached masses of ice of curious shape. Varying from a half to a mile or more across, and surrounded by a steep but low ice-cliff, they rose on all sides to a rounded ridge 200 or 300 feet in height. Soundings taken close to these curious ice masses showed them to be aground, and we were much puzzled to account for them, as, although they were irregular in outline and differed in detail, all had the same feature of gradually rising to a rounded central eminence. It was difficult to imagine that grounded icebergs could have assumed this shape, and

almost as difficult to think that under each ice-cap lay some rocky islet. In our then bewildered frame of mind we called them ice islands, and it was not until we had a larger experience and could take a more general view of the glaciation of the whole region that we arrived at any plausible theory to account for their formation. In the fog we headed more than once to pass between and inside these ice islands, but always to run into a deep bay bounded by fast sea-ice, which formed a hummocky junction with the inner end of each island.

Early in the day we became aware that the pack-ice, which we had so long avoided, lay thick in our offing. Occasionally we had to push through narrow streams which opened out into broader masses on our left. It seemed as though we were threading a narrow channel left along the shore by the effect of the easterly wind on the moving ice.

At 4 P.M. (January 30) a more promising lift in the fog enabled us to gather information with regard to our surroundings. Beyond the extensive sheet of fast sea-ice which abutted on the ice islands, we could see the customary ice-cliff of varying height which marked the coastline, but behind this cliff there was now no doubt that the snow surface rose in altitude. The rise in places was gradual, much as we had seen it on the previous night, but in others the slope must have been much steeper, for here the ice-sheet was torn and distorted and descended in heavily crevassed falls. Even in the uncertain light the contrast of light and shadow made it evident that it rose to an altitude of many hundred feet, and consequently that land must lie beneath it ; but, peer as we would into the misty distance, amongst the steep and rugged icy slopes, we could see no sign of bare land, without which our discovery must remain so barren to ourselves.

It was as the bell sounded for our evening meal, and all save the officer of the watch were preparing to descend,

that over the summit of the ice island for which we were making, appeared two or three little black patches, which at first we took for detached cloud. We gazed idly enough at them till someone remarked that he did not believe they were clouds; then all glasses were levelled; assertions and contradictions were numerous, until the small black patches gradually assumed more and more definite shape, and all agreed that at last we were looking at real live rock, the actual substance of our newly discovered land.

Dinner had to wait until on rounding the ice islands we could approach these fascinating patches as near as the fast ice would allow; but this still separated us from them by a great distance, and in the misty, overcast weather we could add but little to our knowledge, as the following extracts from my diary will show:

'. . . At a height of about 2,000 feet several rock patches could be seen. The snow slope from which they emerged seemed to be otherwise gradual and unbroken. One could not say to what height it rose beyond, but the rock alone was sufficient to prove that the tall ice ridges which we saw yesterday and to-day cover solid land of considerable altitude. . . . These particular patches appeared in the centre of a long ridge, the outline of which it was very difficult to distinguish for want of adequate contrast. The wind has changed to the east, so that we may hope for clearer weather.'

It is curious to reflect now on the steps which led us to the discovery of King Edward's Land, and the chain of evidence which came to us before the actual land itself was seen: at first there had been the shallow soundings, and the sight of gently rising snow slopes, of which, in the nature of things, one is obliged to retain a doubt; then the steeper broken slopes of snow, giving a contrast to convey a surer evidence to the eye; and, finally, the indubitable land itself, but even then surrounded with such mystery

as to leave us far from complete satisfaction with our discovery.

As we continued our course to the N.E. we held close along the fast ice which prevented us from approaching to the land. The weather was still dull and overcast, but we could see that the fast ice on our right was no longer plain sea-ice; at the edge it stood seven or eight feet above the water, and seemed to rise to fifteen feet or more on the slope of the cornice that overhung the edge, after which the surface ran back on the level for many miles. We could see hazily the extent of this plateau and the rocky exposure of the land which lay beyond. It is difficult to account for this ice-sheet; it was too thick to be considered sea-ice, and yet was far thinner than any land-ice or barrier formation that we saw elsewhere. Both before and after this we passed at sea very low tabular bergs, which must have come from such a sheet as this. Our soundings running along this edge gradually increased from 88 fathoms at 8 P.M. to 265 fathoms at midnight; but later we came to several more of the curious ice islands which I have described, and close to these we again got 100 fathoms. During the night some more patches of exposed rock had been sighted, but we seemed in the uncertain light to be increasing our distance from them.

On the morning of the 31st the weather outlook was as dismal as ever, and all outward and visible signs of the land had vanished; we could only guess its proximity by the continuously shallow soundings as we circumnavigated the overhanging capes of occasional ice islands. As the fog lifted slightly in the forenoon we found ourselves surrounded by mighty masses of ice. On the right the ice islands showed more clearly, and on the left were numerous lofty bergs, some of very great extent; one, indeed, we estimated as at least six miles in one direction, and as probably more in another. But yet more unwelcome to our eyes than this formidable array of bergs was

the vast amount of heavy pack-ice which lay scattered in all directions, and blocking the channels between the bergs. Though our hearts sank at the thought of so much obstruction, we could afford to admire such a majestic and impressive ice scene. Under a dark, threatening sky the pack-ice showed intensely white in an inky sea, whilst the towering walls of the icebergs frowned over us, shaded from the palest to the most intense blue.

Most of the icebergs seemed aground, and as their height often exceeded 200 feet and our soundings were comparatively shallow, I have little doubt that the majority were at least temporarily at anchor. For a few brief minutes we could see the distant outline of our snow-covered land as we threaded our way amongst these great ice-masses and through the shifting streams of pack which lay between them, then for the time all attention had to be devoted to navigation. As our water supply was getting short, early in the afternoon we were obliged to secure to a large floe in order to replenish it. We had little difficulty in finding a suitable one, as the pack-ice about us was heavier than anything we had yet seen. It is evident that in this region there is much pressure and a considerable snowfall, as the floes were very hummocky and their snow-covering thick; but the ice itself was by no means so hard as that which we had met near the coast of Victoria Land.

During the afternoon the weather cleared somewhat, and for the first time for many days the sun shone forth. There was little wind, and the low temperature was already forming young ice over the calmer patches of sea. After a few hours' delay we pushed on once more, and, passing through a very narrow channel between two bergs, reached a sheet of open water which appeared to stretch for a long distance to the north, but this was bounded on the right by a sheet of fast sea-ice, whose edge ran almost due north and threatened to carry us

farther from the land which we had last seen trending in a north-easterly direction.

As we could not penetrate this sheet, there was no choice but to follow its edge, which we proceeded to do, hoping that it would eventually turn in a more promising direction.

During the last few days of fog and mist we had seen a few seals and a large number of penguins of both the species which inhabit these regions. The latter appeared to live on the most amicable terms, and it was a common sight to see a few alert, busy little Adélies preening themselves amidst a group of dignified, ponderous Emperors; both showed great curiosity as we passed, and leapt into the water in our wake with loud squawks. What great speed these birds must possess in the water is shown by the manner in which they shoot out of it and land erect on a floe two or three feet above the surface. Occasionally on an exceptionally high ice-edge they miss their aim and, dashing heavily against the ice, fall sprawling back into the sea with wild complaints; but this does not appear to disconcert them, for with wonderful pertinacity they will try again and again to reach their goal. As we advanced, the Emperors grew more numerous, until it was rare not to have two or three groups of a dozen or more birds in sight from the bridge.

In the comparatively clear weather which we enjoyed on the afternoon of the 31st we could get a good view over the immense sheet of sea-ice, which appeared to be gradually carrying us farther from the land. It was quite smooth and showed no sign of pressure, but here and there the ice was sunken and sodden, giving the appearance of large pools of water. At that time we could hazard no guess as to the cause of this decay, though doubtless it is the same effect as we afterwards witnessed in the ice-sheet about the 'Discovery' in places where the current ran over a shallow bottom.

Far in on the ice-sheet we could see a few small bergs securely frozen in and drifted up with snow, and grouped about the base of one or two of these were many hundreds of Emperor penguins. The steady increase in the groups we had met with and their final discovery in such great numbers seemed to indicate that we had at length found their breeding-place, and as this had never yet been seen, our excellent zoologist was all eagerness to explore it; but in the circumstances I thought it hopeless to attempt to cross the treacherous, slushy sheet of ice which lay between, and reluctantly we were forced to steam past this interesting spot, hoping that we might have better fortune on our return journey. In the light of fuller information which we were able to obtain concerning these birds, it seems doubtful whether this really was their breeding-place, but at any rate it would have been interesting to know what they were doing in such numbers.

Our eager outlook for land beyond the great ice-sheet was only partly rewarded; far to the south-east we could see the faint undulating lines of the high snow slopes, but in the dim expanse of white no sign of exposed rock appeared, and even the outlines vanished as the sun travelled lower towards the south.

At midnight an appearance of land was reported in the E.N.E.; a bank of cloud hung low upon the horizon, and its fixed position and unchanging form seemed to indicate that land lay beneath it. Though glasses were constantly directed towards it, no more definite form was ever revealed, but it is curious to note that on the following day a similar cloudy indication was visible in this direction.

It was after midnight on the 31st that we got lost. Leaving the ship steaming along the edge of the fast ice in a northerly direction, as I have described, I went below to snatch a few hours of the sleep of which the late exciting times had robbed me, and have only a dim

recollection of constant reports that the ship had to take a more westerly course owing to ice islands, bergs and pack, and in obedience to a general order to keep in the open water, westerly gradually became southerly, and so on until, as we were headed off again and again, the ship must have worked round a complete circle. She was well on towards a repetition of this manœuvre when I again reached the bridge, and nobody knew exactly where we were. It was evident that the stretch of open water which we had entered through a very narrow channel on the previous evening was surrounded by a chain of immense bergs, between which the channels were sometimes blocked by fast ice and sometimes by heavy pack, and the latter was constantly altering its position and streaming across the bay in the most confusing manner. The only way out of this *cul-de-sac* seemed to be to take the same narrow road by which we had entered, but where was it? Meanwhile the whole bay was covered with a rapidly thickening coating of tough young ice, through which it was by no means easy to force a passage, and it looked as though, had we stopped to consider matters, we should have had some difficulty in starting again. Our bewilderment was, if anything, increased by suddenly coming across the very floe from which we had watered on the previous afternoon. What was it doing here? It was certainly a long way from where we had seen it before. For more than an hour we splintered through the young ice in a very confused frame of mind, when the sharp eye of Mr. Royds brought to our notice a conspicuous feature which we all recognised as belonging to one of the bergs between which we had entered, and soon we skirted round it and to our relief found the narrow passage still open.

The rapid formation of young ice at this season of the year was to some extent alarming. To be obliged to winter in these regions would have been a great calamity,

since we could scarcely hope to have travelled far from our base. At a later date, when we knew more of the seasonal changes and appreciated how frequently young ice is formed and dissipated, even in the height of the Antarctic summer, we should not have regarded this phenomenon as serious, but at this time we had very little to go upon, and were exceedingly glad to get into a clearer sea once more.

At noon on February 1 we were five miles south of our position on the previous day, looking in all directions for some lead which would take us through the thick pack to the N.W. and again allow us to approach the coast at a farther point; but though we entered several promising channels, they speedily ended, where from the crow's-nest one could see nothing but one vast sea of ice.

It now became a question what to do. Should we remain here and wait for the pack to open? There was still a chance that we might be able to push farther to the eastward with patience. But then what of the coast of Victoria Land and what of our coal supply? With young ice forming so rapidly here, it well might be that in a fortnight the harbours to the west would be closed and we could ill afford the loss of coal that waiting here would entail.

I decided to return, but it is natural enough that sometimes vague regrets should arise that we did not attempt to push farther to the east. That we need not have feared the closing of the season is obvious, but that we should have been hard put to it for coal at a later date is equally certain. One can never do quite what one would wish in these matters. In the afternoon the wind came from the east and rapidly cleared the sky as we steered back on the course by which we had come, and, with wind and current fair, so rapidly cleared the ground that by night we were again abreast

of the icy plateau beyond which we had first seen the exposed rock of King Edward's Land.

We could now see the coastline clearly for many miles. On the left was the low barrier formation of which I have already spoken, and which I now note as 'ten to twelve feet high and sloping up for a short distance, when it runs horizontally for ten or eleven miles to the base of a range of well-defined hills.' To the right and left of two groups of hills which lay opposite to us, a thin stratus cloud partially hid the outline of continuously high snow-covered ridges, and the same thin veil hung in the broad valley between the groups; but the sharp peaks of the groups were clearly outlined against the sky, and with a sextant and the distance given by four-point bearing, we were able to calculate the altitude as between 2,000 and 3,000 feet.

The outline suggested a volcanic country, but although many of the slopes were steep, the bare rock appeared only in a very few places; and where some lofty spur was flanked by a sheer precipice, the more gradual slopes at the base of the hills and the deep-cut valleys presented a uniform white surface, save where, here and there, it was broken by crevasses or ice cascades.

Behind the broader valley which separated the hill groups the outline of farther ranges was strongly indicated, and convinced us that the high land extended far back beyond the coastal hills, and that our new-found land was not a group of islets, but a country of considerable altitude and extent. But although we gazed for hours through our glasses and endeavoured to drink in every detail of this distant view, we could not but long to traverse the snowy plain and throw yet more light on our discovery. Had we then known our sledge equipment and dogs as we afterwards came to know them, had we been as prepared for such adventures as we afterwards were, I should certainly have

made a dash towards the distant hills. As we were then situated, the plan, though it occurred to us, seemed to involve unjustifiable risk and delay. Such are the disadvantages of inexperience.

Throughout the night the bridge was well occupied until the low skimming sun, gradually facing us, obscured all detail in its glaring path, and the officer of the watch was left to face the chill morning hours alone. By the morning our course had turned again from west to south, and in bright weather we skirted a lofty ice-cliff which before we had only seen dimly through the fog. Throughout the day this ice-cliff rose and fell; when it was low, we could see high rising snow-slopes in the background, and whilst calculating that they rose to a height of 950 feet, had again to deplore the want of definition which rendered exact observations impossible.

Many grounded and tilted bergs lay in the offing, and here and there was one which, though detached from the cliff, had tilted and remained at anchor close to it. The conditions were quite different from those which obtained along the barrier edge, and we could not doubt that the ice which we saw was firmly planted on the ground and broke away as it became water-borne. In the afternoon for a brief space the ice-cliff rose to a height of 280 feet, and we passed close to this sheer wall of ice, the highest that we were ever fated to see in the Antarctic Regions; as we passed by this huge stationary object, we could see how strongly the current was making with us: it increased our speed by at least two knots. As night approached, the wind, which had been increasing throughout the day, descended on us with great violence from the high ice-cliffs, filled with whirling clouds of drifting snowdust swept from the plains beyond; the temperature fell to 5°, and soon the rigging was festooned with icicles and the decks covered with a thin layer of ice. The date corresponded with

August 2 in England, and we wondered how flannel-clad holiday makers would enjoy an Antarctic summer, and, as this sort of thing was the Antarctic summer, what the Antarctic winter would be like.

We steered away from the ice-wall and escaped from the clouds of drift, only to get into a sharp sea where the wind raised clouds of spray which froze solid as it fell.

Later in the night the wind fell to a flat calm, and before the temperature rose the whole sea was covered with pancake ice, but as the sun gained power the temperature crept up to 22°, and with a slight breeze the young ice quickly vanished. In reflecting on recent experiences, although at this time our ideas were not thoroughly sifted, I vaguely realised that indications pointed to the fact that the Great Barrier did not rest on land, and since the ice which we had seen to the east undoubtedly did, there must be some place where the conditions changed, some junction which we ought to explore. Somewhere abreast of us now should be one of those deeper indentations in the ice-mass, where we might reasonably suppose the change took place, and it occurred to me that we might glean further knowledge by re-examining this part. As we had been driven some way to the northward, it was several hours before we were sufficiently close to recognise the deep bight for which I had determined to make, and it was well on in the afternoon before we turned into it and had the ice on each side of us. We found that the inlet had several branches; selecting the most southerly, we turned sharply into it and entered a creek facing towards the east, inside which we were completely shut off from a view of the sea. The ice-wall which surrounded us rarely rose above twenty feet, and in places descended almost to the water level. Selecting a spot on a level with the ship's bulwarks, we placed the ship alongside it and secured her with our ice-anchors so closely that

we were able to step from the rail on to the snow surface beyond. The valley of the inlet was continued between rising snow-slopes for several miles to the west, and in its hollow a continuous crack ran through ice standing only a few feet above the water level. Along this crack were numerous seal holes, and quite a hundred of these animals lay asleep on the snow within easy reach of them.

As it was now late, and the light was poor, and as we appeared to be in a secure position, it was decided that work should be deferred till the morrow, and the more energetic were soon mounted on ski and pursuing a very uncertain course over the rough snow. Armitage had asked permission to take a small sledge party in a southerly direction, and with Bernacchi and four men and a light sledge equipment he was soon marching up the valley; and later a black dot on the snow showed us that the party had turned to the south and were mounting the rise.

Skiing did not prove such good sport as was expected. The wind had raised quantities of irregular waves or *sastrugi* on the snow surface, and in the uncertain light these could not be seen until one actually tumbled over them, and as no one progressed more than a few yards at a time without a fall, it was not long before all, except the sledge party, were on board once more, when we took a sounding, and found that there was a depth of 315 fathoms under the ship. On our arrival in the inlet not a fragment of loose ice could be seen, but as we were trying to take the temperature of the water at different depths we found our work much impeded by small ice-floes, which were being crowded into the inlet by a strong surface current that now ran towards and under the ice at the head of the inlet. Feeling in some security, I had looked forward to a quiet night, after many broken ones, but the sight of this ice was not reassuring, especially when amongst

the floes there appeared two or three small icebergs. One of these bore down on the ship before we had sufficient steam to move her, and by the few on deck it was watched with very anxious eyes. As it approached we breathed a sigh of relief, imagining that it would just clear our side by a foot or two, but on coming abreast of us it slowly turned and a small projection on it caught and grazed our side. As far as the berg was concerned it was the merest glancing touch, but, wrenching a large piece out of the solid oak covering board, it gave the 'Discovery' a squeeze which caused every beam and frame to groan, and brought all hands on deck with scared faces. This berg was not more than twenty yards across, and its top, which was irregular and pinnacled, was nowhere more than twenty feet in height, nor was it travelling with any great speed; yet the shock of a mere graze from it was great enough thoroughly to alarm everyone below, and there can be little doubt that had it met us fair and square the consequences might have been most serious. It is difficult to realise what an overwhelming force even a small berg may represent, until one remembers that it is, perhaps, barely one-sixth of its mass that is visible, and that there must be always thousands of tons submerged to support the hundreds which are seen.

Even with this knowledge, after beholding the stupendous masses of ice which are borne high on the great flat-topped bergs, we had been perhaps inclined to pay too little attention to the more insignificant-looking ones, but we learnt now that an iceberg of any dimensions is not to be trifled with, and it can be imagined that whilst we remained in the inlet we had steam at very short notice as well as a bright look-out. On the following morning our berg, as well as the pack-ice, took its way out to sea again, clearly showing that there is a regular tidal stream in this region; and as, in spite of this, we and

the barrier-ice about us rose and fell together, there was no doubt that at least this part of the barrier was afloat.

At an early hour on this day, February 4, we commenced to make preparations for a balloon ascent to extend our knowledge of the surrounding region.

It was Sir Joseph Hooker who first suggested the carriage of a balloon for obtaining a view over the great southern ice-wall, and when, after much difficulty, the necessary funds for this equipment had been raised, we had decided that the best thing for our purpose was one of the small captive balloons used by the army for lifting a single observer.

Thanks to the sympathy of the War Office we had been enabled to purchase a complete equipment of this description, consisting of two balloons, which, when neatly folded, occupied very little space, and a quantity of hydrogen gas, carried in steel cylinders at high pressure, which occupied a great deal. Indeed, it had been a great problem where in our small ship to stow these cylinders, of which there were more than fifty, containing something over three fills for the balloon, and it was only by placing them on top of the deck-houses and by utilising every other spare space about the deck that we had managed to solve it.

And as it was of little use to carry such a costly outfit without a knowledge of how to employ it, before leaving England I had taken advantage of the kind suggestion of the chief of the ballooning department at Aldershot, Colonel Templer, R.E., and had sent two officers and three men to receive some instruction at his hands.

I now found that although officers and men had regarded their short course as a most excellent diversion, they had picked up most of the wrinkles and had learnt to proceed about their work in the most business-like manner.

First a large sail-cloth was spread on the snow, and

a number of cylinders carried out and placed near by. Then the balloon was taken out with tender care, laid on the sail-cloth and connected to the cylinders with many small pipes. As the gas gradually inflated the empty case the sticky folds were carefully straightened out until the time came for the process of 'crowning' the balloon, when the gradually filling carcase was centralised and covered with its net, well weighted with sandbags.

The contents of cylinder after cylinder were added, until gradually our balloon became a thing of life swaying about in the gentle breeze; but the temperature was down to 16°, and owing to the contraction of the gas wrinkles were still visible on its surface after it had absorbed its correct allowance of sixteen cylinders containing 500 cubic feet apiece, and it was not until we had brought out and emptied three additional ones that its name 'Eva' could be read on a smooth, unwrinkled surface.

The honour of being the first aëronaut to make an ascent in the Antarctic Regions, perhaps somewhat selfishly, I chose for myself, and I may further confess that in so doing I was contemplating the first ascent I had made in any region, and as I swayed about in what appeared a very inadequate basket and gazed down on the rapidly diminishing figures below I felt some doubt as to whether I had been wise in my choice.

Meanwhile the balloon continued to rise as the wire rope attached to it was eased, until at a height of about 500 feet it was brought to rest by the weight of the rope; I heard the word 'sand' borne up from below and remembered the bags at my feet; the correct way to obtain greater buoyancy would have been gradually to empty these over the side of the car, but with thoughtless inexperience I seized them wholesale and flung them out, with the result that the 'Eva' shot up sud-

denly, and as the rope tightened commenced to oscillate in a manner that was not at all pleasing. Then, as the rope was slackened I again ascended, but, alas! only to be again checked by the weight of rope at something under 800 feet. Our wire rope was evidently too heavy to allow greater altitude, and the only lighter one we possessed seemed not quite within the bounds of safety should the wind increase.

But, as it was, my view was very extended, and probably afforded as much information as would have been obtained in a loftier position. The following I take from my diary:

'Here the nature of the barrier surface towards the south could be seen well. South of the rising slope ahead of the ship I had expected to see a continuous level plain, but to my surprise found that the plain continued in a series of long undulations running approximately east and west, or parallel to the barrier edge; the first two undulations could be distinctly seen, each wave occupying a space of two or three miles, but beyond that, the existence of further waves was only indicated by alternate light and shadow, growing fainter in the distance. In the far south a bank of cloud had all the appearance of high land, but such indications are now too well known not to be received with caution, and even as I looked through my glasses, faint changes in outline were perceptible. Far over the snow expanse a small black dot represented our sledge party; they must have been nearly eight miles away, and their visibility shows how easily a contrast can be seen on the monotonous grey of the snow.'

When I again descended to the plain, Shackleton took my place, armed with a camera. I had hoped that in the afternoon other officers and men would have been able to ascend, and especially our engineer, Mr. Skelton, and those of his department who had so successfully

inflated the balloon, but the wind was gradually increasing, and our captive began to sway about and tug so persistently at its moorings that it became necessary to deflate it.

The sight of so many seals on the previous evening had reminded us that our winter stock was to be thought of, and whilst ballooning operations were in progress, the majority of our people had been despatched once more on a murderous errand. The work of killing and skinning was now performed with greater dexterity, but the labour of transporting the carcases to the ship was found to be very great, and it was late in the day before it was accomplished and all hands tumbled aboard dead tired.

Meanwhile our sledge party had returned. Armitage reported that he had crossed two undulations before camping for the night, and in the morning had left his camp, and pushing ahead on ski had crossed two further ones. Their temperature during the night had fallen to 0°, whilst at the ship it was +4°; but as six people slept in a tent with bare accommodation for three, instead of suffering from the cold, one or two members had found the quarters so close that during the night they had extricated themselves from the general mass, preferring to spend the remaining hours in the open. It was noted for future guidance that these members reported most unfavourably on the snoring capabilities of the others.

Curiously enough this party was able to report that the undulations were not gradual as we had supposed on seeing them from the balloon, but that the crest of each wave was flattened into a long plateau from which the descent into the succeeding valley was comparatively sharp. Rather than crossing a series of undulations, the party had appeared to be travelling on a plain intersected by broad valleys, the general depth of

which as measured by aneroid was 120 feet. The actual distances travelled were difficult to guess. At this time we were very prone to exaggerate our walks, and it was not until we came actually to measure them later on that we appreciated how slowly we travelled on snowy surfaces. One thing was certain, however; the waves were by no means regular in extent, nor the slopes regular in inclination. At 7.30 in the evening we cast off from the ice and put out to sea, having no desire to spend another night on the look-out for icebergs. During the night the wind carried a heavy drift off the barrier, and covered the rigging with a thick rime, giving the ship a very wintry appearance. We now shaped course directly for Victoria Land, having no longer an object in following the irregularities of the barrier. On the following day, February 5, the wind came fair, and we were able to make sail and so effect better progress.

On the 6th we sighted a large number of icebergs, and suddenly recognised one which had been seen and sketched on January 25 on our passage to the eastward. It was a curious, dilapidated berg, shaped somewhat like a ship, and had one tall column in the centre which one might liken to a dissipated funnel; we had consequently called it the 'Belleisle' berg, in recollection of the woe-begone appearance of the ironclad of that name after she had served as target to a more modern battleship.

We were naturally eager to find out how far this berg had travelled in the interval, and were most surprised to learn that now after twelve days it had only drifted seventy miles to the westward, an average of six miles a day. As I have pointed out, the ship experienced a strong westerly set when cruising along the barrier, and there can be no doubt that the pack-ice and smaller bergs are carried along by this at a far greater speed than is represented by the above figures; one can only suppose that the current experienced was merely a

surface current, and that the larger bergs are influenced by the deeper water which is not moving so rapidly. Possibly also the current in the surface waters, like those in McMurdo Sound, are seasonal and only follow a seasonal prevalence of easterly winds. At this time easterly winds were certainly prevalent, but there seems some reason to doubt whether they are so at all seasons.

On our return along the barrier we had experienced much lower temperature than on the outward journey, and as this strongly suggested an early closing of the Victoria Land harbours we were anxious to delay our western journey as little as possible. In some alarm lest we were already over-late, we were anything but reassured when on the morning of the 7th the temperature fell to $+2°$ and we were enveloped in a thick fog of ice-crystals. We could only console ourselves by reflecting that these exceptionally cold temperatures were produced by a wind from off the great snow-plains of the barrier, where probably at no time of the year were the temperatures other than severe.

Early on the 7th we caught glimpses of the land through the patchy fog, and now, being under sail alone, we were obliged to haul to the north to give it a wide berth. The icy fog had so stiffened the ropes and sails, and had made the decks so slippery, that it was only with difficulty we could brace round the yards, and the men, who had frequently to work with bare hands, suffered much from frozen fingers before we had settled down to the new course. The wind dropping later, we were obliged to get up steam, and soon after to furl sails, but by this time the fog had cleared, and we could see clearly the massive outlines of Terror and Erebus. In the evening we rounded Cape Bird, but in such repeated and heavy snowstorms that frequently we could not see the bowsprit from the bridge, and were forced to stop and wait for the clearer intervals. The

temperature, however, had risen nearly 20° and the air felt mild and soft in comparison with that which we had lately experienced. By the morning of the 8th we were once more in McMurdo Sound; a south-easterly wind and a falling temperature were gradually clearing the skies and revealing the same magnificent scene of mountain and glacier on which we had so recently gazed.

The heavy pack which had obstructed us before seemed now to have vanished, and as we eagerly scanned the coast of the mainland our hopes rose high that we should find some sheltered nook in this far south region in which the 'Discovery' might safely brave the rigours of the coming winter, and remain securely embedded whilst our sledge-parties, already beyond the limits of the known, strove to solve the mysteries of the vast new world which would then lie on every side.

CHAPTER VI

FINDING WINTER QUARTERS: A FATAL ACCIDENT

In McMurdo Sound—A Glacier Tongue—Landing South of Erebus—Selection of Winter Quarters—Prospects—Difficulty in Maintaining our Station—Erection of Huts—Amusements—A Trip to White Island—Sledge Party to the Cape Crozier Record—Accident to Returning Sledge Party—Fatal Result to poor Vince—Results of Search Parties—Frost-bites—Wonderful Escape of Hare—Visit to Danger Slope.

> Beholde I see the haven near at hand
> To which I mean my wearie course to bend;
> Vere the main sheet and bear up to the land
> The which afore is fairly to be ken'd.
>
> SPENSER: *Faerie Queene.*

IN remembering the extraordinary distinctness with which we had been able to see distant mountains in fine weather, owing to the clearness of the atmosphere, the reader may have been led to suppose that under these conditions the 'crow's-nest' of the 'Discovery' would have commanded a very extensive view of the sea surface. This was by no means the case: unless indicated by an ice-blink, the presence of pack could never be detected at more than four or five miles even from that elevated position, and it was often our lot to be steaming towards an apparently open sea, and in less than an hour to find ourselves surrounded by ice-floes. Similarly, it was not possible when steering through the

pack to see the open-water leads, or to extend the prospective track to a greater distance than two or three miles.

It can therefore be understood that although on the morning of February 8 we were steaming across McMurdo Sound in open water, and could clearly see the high mountains on each side, we could not see more than a very limited portion of the extensive surface of the Sound, nor tell when we might again find ourselves obstructed by masses of pack-ice.

On January 21 we had been foiled in an attempt to follow closely the coast of Victoria Land to the south of Granite Harbour, and especially we had been unable to examine a spot where the configuration of the rocky cliffs gave promise of a second and more southerly harbour for our wintering.

We now headed directly for this spot, and my diary records the proceedings of the day as follows:

'. . . On this occasion we got within eight miles before meeting with the same slabs of pack-ice which caused us so much trouble before. On closer approach, the deep valley between the bluff headlands turned out to be partially filled with an immense glacier, and at first sight it appeared as though very little shelter could be hoped for. Later, however, as we skirted the pack towards the south, we found that a long ice-tongue projected partly across the entrance, and undoubtedly good shelter could be found behind this. . . . But now, the ice being so free to the S.E., we pushed on in that direction, seizing the opportunity of examining the bay, and hoping to find quarters still further to the south. Gradually the sky cleared, and shortly after noon the sun shone forth and the clouds rolled away from the hills, leaving us in possession of a magnificent scene. To the left was Erebus puffing forth light clouds of vapour, and, slowly opening to the south of it, the clear outline

of Terror. The slopes of Erebus ran gradually down into the bay, almost completely snow-covered, but here and there an ink-black rock jutted into the sea and gave definition to the hazy coastline. The very high mountain which had been so conspicuous behind our harbour now passed to the left of it, and extended itself into a range exhibiting three magnificent peaks. . . . Some thirty degrees from this our former cone mountain' (afterwards Mount Discovery) 'stood out, impressively isolated; many declared it to be also an active volcano. The western coastline, after leaving the ice-foot protecting our new harbour, runs back into a deep bay, the southern horn of which touches the slopes of the cone mountain; ranges of comparatively low foothills stand behind the inner part of the bay, and five or six islets in the bay form a strong contrast to the snow behind. Another low range of hills flanks the cone mountain on the left, and separated from these by a long and barely perceptible snow bank is yet another low range. This snow bank is due south, and over it in the dim distance the faint outline of very distant hills can be seen. But from the left extremity of the last range to the long cape which bounds the slopes of Erebus, nothing could be seen; so with renewed hope of finding a strait we skirted the pack in this direction.

'During the forenoon and afternoon we passed through extensive sheets of young ice two or three inches in thickness, and all day a school of grampus (*Orca gladiator*, killer whale) were playing about the ship, often coming within a few feet of the side and scattering the young ice as they rose to breathe. Early in the afternoon we came suddenly on a low foot of fast glacier-ice, which appears to be the extremity of a long tongue running for many miles out of the bay to the right of the cone mountain. Its formation is most peculiar. The surface is covered with numerous spiky pinnacles and ridges many feet

in height; I can think of no less fanciful resemblance than to compare them to tombstones in a cemetery.

'A boat was got out to examine it, and we found that the surface of the ice between the pinnacles was covered with a thick deposit of volcanic sand, amongst which were evidences of numerous water-courses now dried up; evidently the heat absorbed by the sand has melted these channels, leaving the pinnacles between. It was by no means easy to clamber over this confusion of ice and rubble, and it would be quite out of the question to drag a sledge through it; it is to be hoped, therefore, that we do not meet many such obstructions on our journeys. A few hundred yards from the edge, the winding of the water-channels had produced some very beautiful, as well as curious, effects. In places the rush of the stream had undercut the channel till the bank overhung its base by many feet, leaving a deep cave beneath, in which the intensest shades of blue could be observed, whilst from the overlapping edge hung a fringe of sparkling icicles; in others a platform of stones and rubble stood poised on a slender shaft of ice, high above the bed of the stream; here the water had run placidly over a smooth, polished ice-floor, and there its surface had been broken as it glided over a bank of rounded boulders. From the ship it had seemed that the disturbed ice would not rise more than breast-high as one stood amongst it, but as one descended into the courses of these streams the fantastically twisted pinnacles of ice rose high above one's head and completely shut out all view of the ship and the mountainous scene beyond.

'We found on the ice the skeleton of a fish eighteen inches in length, probably carried here by a seal; it is interesting to find that fishes of such size exist in these cold seas. Off the edge of the ice we got a sounding in ninety-five fathoms, and whilst the ship was being swung for her compasses, a small dredge produced a

fairly rich haul of animals from the bottom. Our biologist, Hodgson, being on the sick list with a chill, we proceeded to make this catch with all possible secrecy, hoping to reward him with the result; but, unfortunately, the secret leaked out, and, zeal overcoming caution, our sick man was soon in the thick of it, with openly expressed scorn for our amateurish efforts; entreaties had to be extended to commands before, for his own sake, he could be driven back into the milder atmosphere below.

'Rounding this tongue of ice we found our further progress to the south barred by a sheet of fast sea-ice, and skirting along the edge of this, we now find ourselves steering almost due east, and heading towards the long ridge of small uncovered hills which extends from the southern slopes of Erebus, and ends in an abrupt and conspicuous cape which we hope will point us yet further south.'

It was 8 P.M. before we found that the ice edge which we had been skirting extended continuously to this cape, and hopes of an open strait vanished; but we continued our course until at ten we were close to the black, bare volcanic land of the cape. We made for a small rocky promontory without getting soundings with our hand lead, until our bows gently grounded on a bank within a few yards of the shore; backing off from this we found deep water alongside the ice-foot in the small bay on its northern side, and here we secured the ship with our ice-anchors. Later I write:

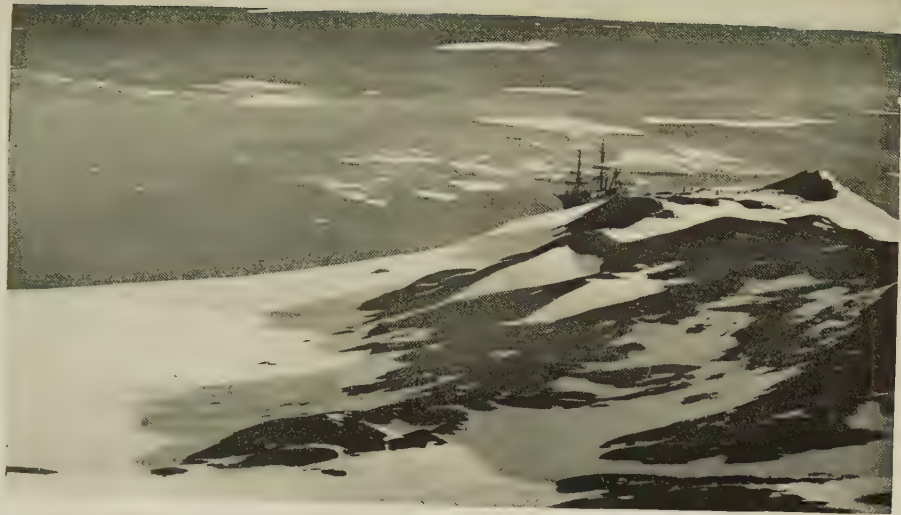
'We have now to consider the possibility of making this part of the bay our winter quarters. From the point of view of travelling, no part could be more seemingly excellent; to the S.S.E. as far as the eye can reach, all is smooth and even, and indeed everything points to a continuation of the Great Barrier in this direction. We should be within easy distance for exploration of the mainland, and apparently should have little difficulty in

effecting a land communication with our post office at Cape Crozier. There are no signs of pressure in the ice; on the other hand, the shelter from wind is but meagre, and one can anticipate intense cold and howling gales. On the whole to-night I feel like staying where we are.'

It is interesting to recall our first impressions of a region which we were destined to know so well, and to observe that in a general sense these impressions were correct; in the south only the outlook seemed mysterious, and evidently we did not realise that the southern ranges of hills were detached islands surrounded by a practically level ice-sheet, but, misled by refraction, still imagined them to be connected by comparatively high snow-covered ridges.

On the 9th, the day following our arrival, we set out to explore our immediate surroundings; the ship, as I have mentioned, lay on the north side of a small promontory. Our first discovery was that there was an excellent little bay on the south side. The sea-ice had not yet broken away in this bay, but it was evident that it would only be a matter of a few days before it did so, as the ice was cracked in all directions. Here, then, was a promising spot in which to establish ourselves for the winter; my determination to remain in this region was much strengthened, and I wrote:

'The small bay completes the shelter from pressure in all directions from S.S.E. to W.N.W., and the remaining space faces the main coastline, from which pressure cannot be expected; the water is shallow enough to prevent danger from drifting icebergs; little difficulty will be found in securing the ship or in finding sheltered spots for the huts within easy reach of the ship . . . . This afternoon the ship broke away from her ice-anchors, leaving a number of officers and men on shore, but before we had drifted far, steam was raised and we secured to the sea-ice on the south side of the promontory. It seems very



WINTER QUARTERS. BAY CLEAR OF ICE. MOUNT DISCOVERY AND BLACK ISLAND IN THE DISTANCE.

difficult to get a good grip with our ice-anchors, and we have now bedded them well, and have supplemented them with the small kedge buried in the snow; our position is not altogether satisfactory, as there is a slight swell and the ship bumps occasionally against the ice-foot. There is apparently only a small rise and fall of tide, I think not more than twelve or eighteen inches. After tea I went for a long walk with Skelton; we struck out over the sea-ice to round the cape, starting on ski, but quickly abandoning them as the snow was hard enough to walk on and too smooth for the ski to grip properly. We found a curious water-hole off the cape, surrounded for a long distance by thin ice which we only discovered when it began to bend ominously under us and we were obliged to separate very rapidly and retire in different directions.' This thin sheet and the open water in the midst of solid sea-ice puzzled us greatly, and it was not until the following year that we discovered that thick winter-ice is actually melted through in the summer where the current flows over a shallow bank. 'We quickly left this doubtful spot, and, skirting further round, headed for a strait which we can now see surrounds Erebus and Terror, placing them on an island. A clear, smooth snow plain can be seen to the further ridge of Terror, the ridge which lies close to Cape Crozier, where the barrier edge meets the land. The presence of an inky-water sky confirms the sea beyond. From the ridge to the right through 120° of arc naught can be seen but the plain level white surface of the Great Barrier. As we mounted a pass in the hills on our return to the ship, we could see these things still more distinctly.

'The ice south of the cape was evidently comparatively thin sea-ice, and we could rejoice in beholding thousands of seals scattered over the white surface—a promising sign that we shall have no lack of these animals in the coming

winter. The ridge of hills under which we shelter is apparently a spur extending from the southern slopes of Erebus.

'To-night there have been most excited arguments. Everybody seems to have been in a different direction, and either, as one would imagine, has seen quite a different scene, or else prefers to describe things in his own language. At any rate, all agree in the insularity of Erebus and the final decease of the Parry Mountains; for the rest, there is nothing that we shall not be able to investigate more definitely at a later date.'

As I have mentioned, in seeking our winter quarters on the coast of Victoria Land so early in February we had been firmly under the impression that the season was closing in, and that the harbours and inlets would shortly be frozen over. With no previous experience to guide us, our opinion could only be based on the very severe and unseasonable conditions which we had met with to the east. But now to our astonishment we could see no sign of a speedy freezing of the bay: the summer seemed to have taken a new lease, and for several weeks the fast sea-ice continued to break silently and to pass quietly away to the north in large floes.

Meanwhile our situation was surrounded with thorny difficulties. Although the ice broke farther afield, it refused to move out of the small bay on which we had set our eyes, and we were forced to cling to the outskirts of the bay with our ice-anchors, in depths that were too great to admit of the larger anchors being dropped to the bottom. The weather changed frequently and rapidly, and often after the ship had lain quietly for several hours a sudden squall or snowstorm would fling her back on her securing ropes, uprooting the ice-anchors and ultimately sending her adrift. Whilst such possibilities remained, in spite of the most earnest wish to save coal it was necessary to retain facilities for getting

up steam at short notice, and the constant work of securing and re-securing the ship was a most harassing addition to the men's work.

At other times the tide and swell would carry the ship into awkward positions with regard to the ice-foot or the shallow bank which lay immediately off it. On February 10 I wrote: '. . . Later, owing to current, the ship forged ahead and forced herself into the fast ice; this brought the bow into deeper water, but the stern swung into the ice-foot and bumped a good deal; in this position she has made a bed for herself, and we cannot haul her out.'

'*February* 11.— . . . The ship bumped heavily during the night and worked herself into a very uncomfortable position, her stern obliquely against the ice-foot, and her bow jammed into the thick fast ice. In the morning we made some attempt to haul her stern out, but only succeeded in carrying away a hawser. In the afternoon all hands were turned on to free her, a boiler was run down, balloon cylinders and other weights transported forward, and a party was set to free the ice at the fore-foot. The kedge anchor was buried fast in the floe, and a large hawser brought from it through the stern to the winch. At seven, when we could get a good strain on the hawser, the ship was gradually freed from her awkward position.'

By the 12th we had managed to get an anchor on the bottom, but the stern had been hauled in to assist the work on shore. 'This morning it blew fresh from the E.S.E. directly over the hills, and, with an off-setting tide and some swell, we began to drag our ice-anchors, the two kedges. For an hour in heavy snowdrift we were endeavouring to check the drag by backing the anchors, but to no avail; at last both dragged out, when there was only just sufficient time to get all hands on board before the ship drifted off.'

In spite of the difficulty of keeping the ship in position, however, steady progress was made with the work on shore, which consisted mainly in erecting the various huts which we had brought with us in pieces. The main hut had been brought from Australia, and was, in fact, a fairly spacious bungalow of a design used by the outlying settlers in that country. The floor occupied a space of about thirty-six feet square, but the overhanging eaves of the pyramidal roof rested on supports some four feet beyond the sides, surrounding the hut with a covered verandah. The interior space was curtailed by the complete double lining, and numerous partitions were provided to suit the requirements of the occupants. But of these partitions only one was erected, to cut off a small portion of one side, and the larger part which remained formed a really spacious apartment.

It had been originally intended that the 'Discovery' should not attempt to winter in the Antarctic, but should land a small party and turn northward before the season closed; the hut had been provided for this party and carried south under the impression that circumstances might yet force the adoption of such a plan. Having discovered a spot in which we felt confident the 'Discovery' could winter with safety, the living-hut was no longer of vital importance; but, even retaining the ship as a home, there were still many useful purposes to which a large hut might be adapted. It was obvious that some sort of shelter must be made on shore before exploring parties could be sent away with safety, as we felt that at any time a heavy gale might drive the ship off her station for several days, if not altogether. With the hut erected and provisioned, there need be no anxiety for a detached party in such circumstances. Later on, too, we hoped that the large room would come in useful as a workshop or as a playroom, or for any purpose which might tend to relieve the congestion of the ship.

We found, however, that its erection was no light task, as all the main and verandah supports were designed to be sunk three or four feet in the ground. We soon found a convenient site close to the ship on a small bare plateau of volcanic rubble, but an inch or two below the surface the soil was frozen hard, and many an hour was spent with pick, shovel, and crowbar before the solid supports were erected and our able carpenter could get to work on the frame.

In addition to the main hut, and of greater importance, were the two small huts which we had brought for our magnetic instruments. These consisted of a light skeleton framework of wood covered with sheets of asbestos. The numerous parts were of course numbered, and there would have been no great difficulty in putting them together had it not been that the wood was badly warped, so that none of the joints would fit without a great deal of persuasion from the carpenter. One of these huts was designed to hold instruments which should keep a continuous record of the change of the magnetic elements on a photographic drum, and it was highly desirable that the record should be commenced as soon as possible.

As may be imagined, with so much work going on on shore and the frequent necessity of looking after the ship, our time was well occupied. But life was not all work, and we found plenty of interest and amusement in our surroundings, as well as relaxation of a more usual character, as the following extracts from my diary will show:

'After working hours, all hands generally muster on the floe for football. There is plenty of room for a full-sized ground in the bay, and the snow is just hard enough to make a good surface.'

'*February* 13.—We hauled the stern into the ice-foot in the morning and carried on hut-building operations. It was calm and clear, and we made good progress. We

tried a team of dogs to tow the light sledge up the hill with pieces of the small huts. Some pulled well, but others are evidently young and untrained; some were extremely timid and grovelled at the least attempt to drive them, others fought whenever and wherever they could. It was not rapid, but eventually all the pieces were got up the hill. . . . Repeated walks are taken to the hill-tops in the immediate vicinity, and eyes are turned towards the south—the land of promise. Many are the arguments as to what lies in the misty distance, and as to what obstacles the spring journeys will bring to light. . . . The officers played the men at football to-night, and won by a goal, but the wind rather spoilt the fun. It is now blowing fresh from the usual E.S.E. direction. Two bergs were seen moving up the bay. This is interesting as showing that the bottom waters must be moving in.

'*February* 14.— . . . We have landed all the dogs, and their kennels are ranged over the hillside below the huts. They complain bitterly, but they are a good riddance from the deck, which is again assuming some appearance of cleanliness. . . . It is surprising what a number of things have to be done, and what an unconscionable time it takes to do them. The hut-building is slow work, and much of our time has been taken in securing the ship; an annoyingly large number of hours have to be devoted to pumping her out; the pumps get frozen and have to be opened up and thawed out with a blow-lamp. Much work is before us when the huts are up: we must land a store of provisions and a boat for emergencies; then there are the instruments to be seen to, more seals to be killed for the winter, arrangements made for fresh-water ice, sledges and tents to be prepared, and a hundred-and-one details to be attended to.

'The sun is now very near dipping at midnight, and

will soon give us an appreciable night. In the morning and evening it is therefore low, and gives the effect of sunset or sunrise for many hours together. The scene is wonderfully beautiful at such times; the most characteristic feature is a soft pink light, that tinges the snow-slopes and ice-foot and fades into the purple outline of the distant mountains. Here and there a high peak is radiantly gilded by a shaft of sunlight.

'Names have been given to the various landmarks in our vicinity. The end of our peninsula is to be called "Cape Armitage," after our excellent navigator. The sharp hill above it is to be "Observation Hill"; it is 750 feet high, and should make an excellent look-out station for observing the going and coming sledge-parties. Next comes the "Gap," through which we can cross the peninsula at a comparatively low level. North of the "Gap" are "Crater Heights," and the higher volcanic peak beyond is to be "Crater Hill"; it is 1,050 feet in height. Our protecting promontory is to be "Hut Point," with "Arrival Bay" on the north and "Winter Quarter Bay" on the south; above "Arrival Bay" are the "Arrival Heights," which continue with breaks for about three miles to a long snow-slope, beyond which rises the most conspicuous landmark on our peninsula, a high precipitous-sided rock with a flat top, which has been dubbed "Castle Rock"; it is 1,350 feet in height.

'In spite of the persistent wind, away up the bay it is possible to get some shelter, and here we take our ski exercise, and find it increases in interest as we make rapid strides towards maintaining our stability. Now that we are able to turn, we can start from several hundred feet up the hillside and come down on an incline for half a mile or more before we reach the sea-ice. It is most exhilarating exercise, and figure after figure can be seen flying down the hillside, all struggling hard

to keep their balance, but generally failing at some critical turn, and coming an "awful purler" to the amusement of the others.'

On February 16 our football and general athletic ground broke away, leaving only a small corner of the bay filled with ice, and skiing became a still more popular amusement. Some days later I find: 'The party of officers who disport themselves on ski is getting more ambitious, and to-day we started from a much higher place. The course started with a quick slope of 120 feet in height, covered with soft snow, on which a tremendous pace was acquired; a sudden lessening in the inclination shot one out on rough hard snow, which not only had to be taken at the same pace, but involved a double turn to left and right, then a slightly milder slope slackened the pace to a sharp corner, where a turn of 120° had to be made before one plunged down the final slope to the sea-ice. One or two of us got down safely, but it was generally touch-and-go at the corners. Skelton is by far the best of the officers, though possibly some of the men run him close.

'*February* 17.—The forenoon was gloriously fine. In a dead calm the sun shone in a cloudless sky; the western mountains were very distinct, but the foreshore was raised and exaggerated by strong mirage. The work is now so far ahead on our huts that we can contemplate some sledge parties. Barne and Shackleton tossed a coin as to who should take the first, and the latter won. Wilson and Ferrar will accompany him. The ice has broken away so far round the corner that I have told them they must take a pram until they get beyond the sea-ice; it will be a heavy drag, but I don't expect they will have to drag it far. All three are very busy making preparations.

'All that remained of the sea-ice in our bay moved out very quietly this morning, nearly taking away

Hodgson, who was fishing on the floe with a tow-net, quite unconscious of what was happening until he looked up and saw his retreat cut off. There was quite an excitement in rescuing him. The wind sprang up again suddenly in the afternoon; we seem fated not to be long without it. It came sweeping down the gullies in bitter gusts. I went up the hill for exercise, and was glad to turn back and sail home.

'Late this evening Walker suddenly appeared, reporting that Ford had met with an accident on the eastern slope of the Gap and needed assistance. It appeared that Ford, Buckridge, and Walker had been "running" the slope on ski in a rather bad light, and that Ford, whose sight is not good, had failed to see a steep drop from the ice-foot and had fallen over it, with the result that his leg had caught in the tide crack and was injured. A party were soon away with a sledge on which they brought back the invalid, the first to occupy our small sick berth. The doctors found that there was a simple fracture, which, though not a very serious matter, will rob us of our ship's steward for some weeks.' The fracture healed with remarkable rapidity, and in less than six weeks Ford was able to resume his duties.

'*February* 18.—It blew hard from the S.E. this morning, but about eight the wind dropped, and during the rest of the working hours it was quite calm and we were able to push ahead with the huts.

'As the ice has broken away around the cape, the sledge party have had stiff work in dragging their sledge and pram over the "Gap"; they will start fair from that side to-morrow.

'There have been arguments lately as to the necessity of a whip in driving dogs, and to-day the two keenest controversialists, Armitage and Bernacchi, who are respectively for and against coercive methods, had a

competition. They selected their own teams, and, whether by accident or design, Armitage selected all the fighting element, whilst Bernacchi's team were mostly the younger and timider dogs. At first neither team could be got to start at all; there was a wild confusion of twisted traces and some exciting fights; but eventually, amidst the cheers of the onlookers, Bernacchi succeeded in coaxing his animals into a trot, from which they broke into a gallop, and, heading up the steep snow-slope, left the driver breathless behind. Whilst this was scarcely the exhibition of control that had been intended, the other team had refused to trot at all, and the honours of the day were of necessity given to the advocate of gentle persuasion.

'It is surprising how suddenly the wind rises and drops here. At 6.30 to-night it came on to blow from the north, and, without warning, in the space of a few minutes a strong breeze was blowing. The hawser securing our stern to the ice-foot parted, the ship swung off, and we were obliged to lower a boat in haste to pick up the men who had stayed to secure the half-built hut. By the time they were on board, it was blowing a gale; we had good shelter from Hut Point, but the swell got up very quickly, and there was soon a considerable commotion in our small bay. . . . At midnight the wind dropped as suddenly as it had risen, and we have now to be prepared for being carried against the ice-foot, which with this swell would probably mean some heavy bumps.' On the following day the wind came as suddenly from the south, and we bumped so heavily on the ice-foot that I thought it advisable to get up steam.

'Later the wind increased to force 8, and we had a scare with a mass of ice bearing straight into the bay. At the last moment it diverted its course and passed harmlessly round the point. . . .' From such extracts as the above it will be seen that it is no easy matter

to secure a peaceful anchorage on the Antarctic coast-line.

'*February* 20.—We have had the first continuous bright windless day since we arrived. The glass was steady at 29.4, the sun shone brightly, and although the temperature did not rise above 18° it was pleasant to loll about in the sun during the dinner hour, when we smoked our pipes in great comfort, sitting on pieces of the hut which are not yet fixed. The dogs are now allowed to run loose, so many at a time; there is much less fighting than would be expected. They are losing their coats, I suppose at about the time they would shed them in the north in preparation for summer, but it seems an awkward look-out when they ought to be preparing for winter. We took advantage of the fine evening to re-secure the ship. I let go two anchors in the bay and middled, then veered both cables till we could just bring her stern up to the ice-foot for landing our gear. She ought to lie much more comfortably now.' On the 21st our energetic first lieutenant, Royds, had a very narrow shave. Late at night, when everyone else was below, he jumped on to a grating which had been placed over the side and carelessly secured; the lashing slipped, and the next moment he was in the water with nothing to hold on by or to assist him in climbing out; with the water at 29° and the air at zero he realised that there was no time to be wasted if he was to reach the deck again safe and sound, and that the chance of his being heard was so small, he would only be wasting his breath by attempting to shout. In this serious position he luckily remembered that a rope ladder had been left over the stern, and husbanding his strength he swam for it. It could have been no light matter climbing that ladder under such freezing conditions, but fortunately he managed to do it, and to swing himself over the side. The first we knew of the accident was

when he appeared in the wardroom with his clothes dripping and his teeth chattering.

On the 22nd our small reconnoitring sledge party returned. After leaving on the 19th they had made directly south towards the White Island, eventually reached it, and climbed one of the nearer volcanic peaks. They were so naturally bubbling over with their experiences that it was some time before we could get answers to our eager questions. From the summit of their peak, for which the aneroid gave a height of 2,700 feet, they had seen the great snow plain of the barrier still stretching without limit through east and south-east to south, and curling a long white arm around the island on which they stood. To the west the same level sea of snow seemed to run deep into the fretted coastline, and again they could see it beyond the high cape which limited our view from the ship. In the dim distance south of our lofty western ranges more high snow-covered peaks appeared. But of the roads it was more difficult to speak; they had crossed ridges and hummocks and crevasses, and had come to see that these things did not advertise themselves afar, but lay hidden in unexpected places under the deceptive smoothness of the plain. It looked as though the best road would lie to the east of the island and well clear of it, but our travellers shook their heads over the bright prospect of a smooth highway, in visions of which many had indulged up to this time.

Altogether we felt that our outlook on affairs was considerably enlarged by this small journey, and we stopped up late as we discussed its bearings and listened for the first time to the woes of the inexperienced sledger. Although the temperature had not been severe, our travellers had nearly got into serious trouble by continuing their march in a snowstorm. They found themselves so exhausted when they did stop to camp

that they were repeatedly frost-bitten. They could only get their tent up with great difficulty, and then followed all sorts of troubles with the novel cooking apparatus. It is strange now to look back on these first essays at sledging, and to see how terribly hampered we were by want of experience. Perhaps the most curious note I have of the report of these three is to the effect that in their opinion our pemmican wouldn't do at all. It was far too rich, they said, and when made into soup it was so greasy that none of them could touch it. Our pemmican contained 60 per cent. of lard, but after knowing how it tasted to a true sledging appetite and seeing the manner in which it was scraped out of the cooking pots in later times, it needs such a reminder as this to recall that it might not be always grateful to a more civilised taste.

This sledge party did something to dispel curious illusions which existed amongst us with regard to distances. On certain days every detail of our surroundings was so clear that it was impossible to persuade oneself that much on which we looked was in the far distance. Shortly after our arrival, for instance, two of our company had started off with the serious intention of taking an afternoon walk around this very 'White Island,' and it was only after they had walked for some hours without noticing any appreciable change in the appearance of the island that they were convinced they had undertaken a task beyond their powers. On another occasion two officers discussed the advisability of making a day's excursion to the top of Mount Erebus and back.

When we had learnt to discount the deceptive appearance of nearness, many of us were inclined to go to the opposite extreme, and to imagine our distances much greater and our mountains much more exalted than they really were. One was led to this by an exaggerated conception of the distance one could walk

in a given time. It was not until instruments and observations had shed the cold light of reason on our sledge marches that we came to know that two miles an hour is very good going on a soft snow surface.

Though our work was much impeded by the cutting winds, we continued to make progress as the month advanced; as yet, however, there were no signs of the sea freezing over, and the old sea-ice, still continuing to break away, had left a large extent of open water to the southward and eastward of Cape Armitage. The seals had no longer a resting-place within two or three miles of the ship, and we had been forced to kill them at this distance in providing for our winter consumption. Not wishing to drag the carcases such a long distance until they were required, we had left them partly buried in snow, but on revisiting the spot somewhat later we found to our dismay that the skua gulls had been at our *cache* and had wrought great havoc. It was extraordinary to see the manner in which they had torn the frozen flesh from the bones with their powerful bills.

'*February* 26.— . . . The main hut is roofed and the windows placed; there is little more to be done outside, though the whole of the inner lining has to be put up. The first magnetic hut is almost finished; a good quantity of provisions and oil has been landed, with fifteen tons of coal. I feel we can now leave the ship without anxiety, and have been pushing forward our arrangements for the first trip, which I hope to lead myself. The object will be to endeavour to reach our record at Cape Crozier over the barrier, and to leave a fresh communication there with details of our winter quarters.

'The snow on the "ski" slopes has become very hard and rough, and we can no longer enjoy that exercise.

'*February* 27.—I went out with Barne on ski, and was foolish enough to try to run the upper slope, which is

now covered with hard *sastrugi* (wind waves). As I was coming down at a good pace, my right ski was turned by one of these, and in falling I brought a heavy strain on my right knee, and damaged the hamstring. I was forced to limp back and get it bandaged.' On the following day I found my leg much swollen, and could scarcely put foot to the ground, and to my great annoyance, as the days went on, the improvement was so slow that I had to abandon all idea of accompanying the sledge party to Cape Crozier, and to content myself with deputing the charge to Royds. I already foresaw how much there was to be learnt if we were to do good sledging work in the spring, and to miss such an opportunity of gaining experience was terribly trying; however, there was nothing to be done but to nurse my wounded limb and to determine that never again would I be so rash as to run hard snow-slopes on ski.

By March 4 the preparation of the sledge party was completed. The party consisted of four officers, Royds, Koettlitz, Skelton, and Barne, and eight men, and was divided into two teams, each pulling a single sledge and each assisted by four dogs. I am bound to confess that the sledges when packed presented an appearance of which we should afterwards have been wholly ashamed, and much the same might be said of the clothing worn by the sledgers. But at this time our ignorance was deplorable; we did not know how much or what proportions would be required as regards the food, how to use our cookers, how to put up our tents, or even how to put on our clothes. Not a single article of the outfit had been tested, and amid the general ignorance that prevailed the lack of system was painfully apparent in everything. Though each requirement might have been remembered, all were packed in a confused mass, and, to use a sailor's expression, 'everything was on top and nothing handy.'

Even at this time I was conscious how much there was to be learnt, and felt that we must buy our experience through many a discomfort; and on looking back I am only astonished that we bought that experience so cheaply, for clearly there were the elements of catastrophe as well as of discomfort in the disorganised condition in which our first sledge parties left the ship.

However, at the time few of those actively employed had time or inclination to consider their unfitness; all was bustle and hurry to depart, and at length the order to march was given and the party stepped out briskly for the steep snow-slopes. By this time the sea-ice had broken past the eastern slope of the 'Gap,' the peninsula could be crossed only by climbing the higher passes, and the sledges had to be dragged to an altitude of nearly 800 feet before the level plain of the barrier could be reached. It was not until the following day, therefore, that the retreating figures of the party were lost to our watchers on the hilltops, and we settled down to wait for their return.

It was about this time that we first began to notice the strange relation between the direction of the wind and the temperatures we experienced in our small bay. 'With the wind from north or south, or anywhere to the westward of these points, the thermometer rises above 20° and the air is soft and mild. But should an easterly wind arise—and this is the most constant direction of our winds—the temperature falls to zero or below, and the air is rendered more biting by fine particles of snow blown from the hill surfaces. Last night light airs were succeeded by a squally southerly breeze; the thermometer showed a maximum of 25°; I noticed my bunk unusually warm, and in the morning found water on the upper deck. To the eastward is the barrier, and doubtless the cold weather is due to air carried from its extensive surface. . . . The northerly

breeze coming from the sea would naturally be warmed, but it is difficult to account for the warmth of the southerly winds, unless it is an effect of descending currents from the higher levels. We should welcome both northerly and southerly breezes were it not that the first brings a swell and the last a continual prospect of being beset by drifting ice. Of the several evils, the least is undoubtedly the cold, and with a southerly wind especially one does not feel that our bay affords a good protection; luckily, so far, it has not lasted at any time for more than a few hours, nor has it blown with any great force. We have only experienced the lightest puffs of air from the west, in which direction our bay affords least protection.

'We have now got our windmill up, and it revolves merrily. The mill regulates itself to a certain extent by its large rudder, which causes it to face more obliquely to the wind as its force increases, but this is only partial regulation, and with changes in the wind there is considerable variation in the speed of the mill. The dynamo stands on deck beneath the mill, and has an ingenious contrivance with a sucking magnet to regulate the current output by altering the resistance in the field magnets. This does not work so well as one could wish, and though the cells are gradually charging I do not like the variations in the current which is effecting this. Dellbridge and I have been going into the matter, but I fear the sucking magnet will never be very satisfactory. To-night we had electric light below for a few hours; it made our quarters look wonderfully bright and comfortable, and will be the greatest boon if we can only keep it going during the winter; but besides the dynamo, the cells will need a lot of attention; one or two are already showing signs of sulphating.

'The main hut is now finished and looks quite a palatial residence. The Eschenhagen magnetographs have been

in full swing since the term day, March 1, thanks to Bernacchi's energy; there will be much difficulty, he thinks, in maintaining an equable temperature for these instruments. I hope it can be overcome to some extent by banking the hut with snow.

'*March* 9.—The young ice forms quickly when it is calm, especially at night, but when the wind springs up it is soon driven out.

'I was able to get about sufficiently to go rounds and perform our short service. Without Royds and the harmonium the hymns were a difficulty, but we chose the simplest tunes. A calm but dull morning was succeeded by the most glorious afternoon. The sun was warm and bright, and it was pleasant to sit about in its rays. I was sorely tempted to try to walk abroad, but wisdom kept me chained on board. We have now been here a month and a day; it is odd to think that we expected to be frozen in on arrival, a miscalculation of a whole month; but what could one suppose from the evidence we then had before us? In addition to the records of former expeditions to these seas, I find that the "Belgica" ceased to move after March 4 when far to the north of us. The bay is full of young ice and the swell has almost gone; it appears as if our little corner was at last to be frozen in. To-night the sun sinks behind our western range in a sky of rosy glory, and deep shadows fall across the frozen bay.

'*March* 10.— . . . Again a fine bright day, though there was some wind in the night. My leg better, and was able to hobble to the shore station on a tour of inspection. Quite a number of small round sponges have been picked up on the hillsides; they must have been cast up on the ice-foot and there dried, until they became so light that the wind caught them up and whirled them to the rocky crannies above. The men go out very regularly for exercise; they have mostly given up their

ski and have taken to tobogganing. Toboggans are made of a pair of ski and the end of a packing case. As many of the slopes are extremely steep, the pace is sometimes terrific, and the least unevenness of surface inevitably causes a capsize, when toboggan and man come whirling down in a cloud of snow, much to the delight of the onlookers.

'The sun circles so low now that the effects of sunset are visible for many hours, and the changes of light are very gradual and very beautiful. As I returned from my walk at six, the western sky bore a saffron tint, deepening to crimson where the dark blue mountains were clearly outlined against it; the fleecy clouds showed dark, with bright gilded edges where they stood against the sky, and whitish grey where they nestled in the distant valleys. And yet now, five hours later, though heavier cumulus clouds have spread overhead, the saffron tint can still be seen through breaks in the cloudy mantle, whilst the clear horizon has only turned to a richer crimson. The beauties of the sky are reflected in deeper tone on the patchy surface of the young ice, in which a few puffs of wind have traced ink-black leads of open water. But it is still sunset, as it was five hours ago.'

Tuesday, March 11, was to be one of our blackest days in the Antarctic, but we had little suspicion of this as the daylight hours passed quietly, and we remained snugly in our comfortable quarters on board the ship. Since the departure of our sledge party the weather had been exceptionally fine; but we awoke on the 11th to find the wind blowing from the east; in the afternoon it increased in strength, and the air was filled with thick driving snow. The main part of our outdoor work was accomplished, and as there was plenty to be done on board we did not attempt to face the inclement conditions outside, but sat down in comfort to our tasks with an occasional thought for our fellows who were less happily cir-

cumstanced. On the previous evening a report had been brought in from the hilltop that a spot had been seen in the distance, which was thought to be our sledge party returning. Though we considered it rather soon for them to appear, we did not imagine that anything could be wrong, and only lamented for their sakes that they should be obliged to support this weather in a tent rather than with our own comfortable surroundings. At the worst no one suspected that they could be anything but weather-bound and uncomfortable. It was not until half-past eight, when it was quite dusk without, that our tranquillity was rudely shaken by a report that four men were walking towards the ship. The sense of trouble was immediate, and all hastened on deck; we could scarcely recognise the newcomers as they climbed over the side in the thick whirling drift, but the first disjointed sentences were enough to show that all was amiss, and we hurried them below. As they emerged from their thick coverings we recognised them as Wild, Weller, Heald, and Plumley, and it was evident that though thoroughly exhausted they were labouring under strong excitement. In such circumstances, and from so many mouths, it was almost impossible to get a connected tale, and it was not until I had selected Wild, as obviously the most cool and collected of the party, and had called him aside, that I was able to get an idea of what had happened; and even then I could only get a meagre outline such as follows:

They had been sent back, he said, a party of nine, in charge of Mr. Barne, and early in the day had reached the crest of the hills somewhere by Castle Rock; besides the three with him now, there had been Mr. Barne, Quartley, Evans, Hare, and Vince; they had thought they were quite close to the ship, and when the blizzard came on they had left their tents and walked towards her supposed position. They found themselves on a

steep slope; couldn't see anything, but tried to keep close together; suddenly Hare had disappeared, and a few minutes afterwards Evans went. Mr. Barne and Quartley had left them to try to find out what had become of Evans, and neither had come back, though they waited. Afterwards they had gone on, and then suddenly found themselves at the edge of a precipice with the sea below; Vince had shot past him over the edge. After much trouble they had climbed back, reached some rocks, and groped their way to the ship; he feared all the others must be lost; he was sure Vince had gone. Could he guide a search party to the scene of the accident? He thought he could—at any rate, he would like to try.

The information was little enough; at any rate, it was something on which to act, and the details could be filled in later. But meanwhile the practical common sense on board had outstripped orders, and already warmer clothing and wind coverings were being hurried on by all, and a sledge with a fur sleeping-bag and medical comforts had been equipped. But the ship could not be deserted even for such an errand as this, and when Mr. Armitage had chosen four officers and ten men to accompany him, it was felt that numbers had already reached the limit of usefulness, and that others like myself must wait in dreary inaction whilst the few laboured. Though the first disastrous tidings had been brought to us at 8.30, it was still before nine when the relieving party tumbled over the side and vanished into the gloom.

It will be as well to relate now the actual story of the original sledge party, as we learnt it in after-times, and to trace the steps which had led to the accident.

The party, after crossing the hills on March 4 on their outward journey, had descended to the level ice and directed their course into the deep bay which lies on the eastern side of our peninsula and south of Erebus and

Terror. After crossing some ice-ridges they found fairly easy travelling for ten miles or more, but then came to very soft snow, where at each footstep they sank to a depth of eighteen inches or two feet. The labour was excessive, and the dogs were of no assistance, but they struggled on in hopes of coming to better conditions. After three days Royds saw that it was useless to continue as they were going, and that the only chance of making progress was to use snow-shoes, but unfortunately there were only three pairs of ski with the party. He decided, therefore, to push on for his mission at Cape Crozier with two officers only, and to send the remainder back in charge of Barne. The separation took place on the 9th, and the returning party, finding a somewhat easier road, were able to retrace their steps at a more rapid pace. They came abreast of Castle Rock on the morning of the 11th; and, although this was not the way by which they had descended from the hills, Barne thought that the incline at this place looked more gradual and would prove an easier road to the summit than that by which they had come, and so decided to take it. In expectation of a stiff and slippery climb, he directed his men to put on the loose leather ski boots which they carried instead of the softer fur boots. The ski boots were frozen hard, and although most of the party got them on after much difficulty, Vince and Hare had to give up the attempt and were allowed to continue in their fur boots. Barne's report proceeds: 'Neither Primus lamp could be used on account of the prickers being broken. At 9.45, the weather being clear, we started, particular care having been taken to pack the sledges securely to prevent damage in case of capsize during the ascent. The hill can be easily ascended by taking a zig-zag course, the surface of the snow being in broad natural steps. Finding, however, that we could haul the sledges straight up, I did so, making for Castle

Rock. We stopped twice for rests, and reached the top of the ridge about half a mile south-west of Castle Rock at 1 P.M. We had scarcely gained the ridge when it began to blow from the south-east, and the air was filled with snow. I had just time to take a bearing of Crater Hill before it was obscured, and I intended to make for it along the ridge, but as several of the crew were getting frost-bitten and the sledges were being blown over, I thought it best to camp, and made for the shelter of some rocks which I had seen before the wind sprang up. On finding them we got as much as possible under their lee and pitched our tents, getting the men in as quickly as possible.'

The tents being up, the party crept into them, already exhausted from their heavy pull up the long incline, and more or less frost-bitten from their last efforts in the driving snow. At ordinary times hot tea or cocoa would have revived their spirits, but now neither cooking apparatus was in order, and they could not even melt the snow to drink with their icy cold lunch. We afterwards weathered many a gale in our staunch little tents, whilst their canvas sides flapped thunderously hour after hour, and we, ensconced in our sleeping-bags, passed our time, if not in comfort, at least without sense of danger. But to this party the experience was new; they expected each gust that swept down on them would bear the tents bodily away, and meanwhile the chill air crept through their leather boots and ill-considered clothing, and continually some frost-bitten limb had to be nursed back to life. It was small wonder that the position seemed intolerable, that their thoughts turned to the comforts of the ship which they imagined to be within a mile or so of them; and after some discussion the fatal decision was made to abandon their sledges and attempt to reach her.

We knew well enough afterwards the rashness of

attempting to move in an Antarctic snowstorm, but at this time it was impossible for us to have known fully the serious nature of such an act and the utter confusion which must ensue. It was an experience which had to be bought, and this party were destined to pay the price.

At this juncture Barne's report proceeds: '. . . The tents were rolled up and secured, the dogs unharnessed, and we left the sledges. Before leaving I impressed on the men, as strongly as I could, the importance of keeping together, as it was impossible to distinguish any object at a greater distance than ten yards on account of the drifting snow. The two men wearing fur boots had a man on either side to prevent them from slipping. Our progress was very slow, as we were greatly delayed by the men in fur boots, who had difficulty in walking on the slippery, uneven surface. As we proceeded the surface inclined to our right front until it was evident we were crossing a steep slope on which it was more and more difficult to keep a foothold. . . . About ten minutes after we had left the sledges, Hare, who was at the rear of the party, was reported to be missing, and at this moment an unusually violent squall prevented us from seeing even one another. I immediately ordered a chain to be formed at right angles and extending across our track, each man keeping in touch with the next with the idea of intercepting Hare when he came on. We shouted and blew whistles, and whilst this was going on, Evans stepped back on to a patch of bare smooth ice, fell, and shot out of sight immediately.'

Thinking the slope to be one of the short ones so common in the folds of the hills, Barne cautioned his men to remain where they were; and sitting down, deliberately started to slide in Evans's track. In a moment or two the slope grew steeper, and soon he was going at a pace which left him with no power to control his move-

ments; he whipped out his clasp knife and dug it into the ice, but the blade snapped off short and failed to check his wild career. In the mad rush he had time to realise the mistake that had been made and to wonder vaguely what would come next. In a flash, ice changed to snow, which grew softer until, in a smother of flying particles, his rapid flight was arrested, and he stood up to find Evans within a few feet of him. They had scarcely exchanged greetings when a third figure came hurtling down on them out of the gloom and was brought to rest at their feet. This was Quartley, who, growing impatient at Barne's absence, and of course ignorant of what lay below, had started to slide down on the same track, and had been swept down the descent in the same breathless manner. Realising the impossibility of ascending again by the way they had come, they started to descend, but within four paces of the place at which they had been brought to rest they found that the slope ended suddenly in a steep precipice beyond which they could see nothing but the clouds of whirling snow. Even as they recoiled from this new danger and dimly realised the merciful patch of soft snow which had saved them from it, a yelping dog flew past them, clawing madly at the icy slope, and disappeared for ever into the gloom beyond.

Movement of any sort seemed impossible in this whirling storm, and they sat for long huddled together, forlornly hoping for some respite from the blinding drift. At last, chilled to the bone, they felt that whatever happened they must be again on the move, and in a dazed fashion they gathered themselves together and slowly moved along the cliff to the right; they found that it gradually fell, and then suddenly they caught a glimpse of the sea at their feet, and for the first time realised that it was from this they had been saved by the patch of snow almost on the cornice of the cliff.

In a short break in the storm they now saw Castle Rock towering over their heads, and close ahead of them a rocky ridge which ran from its foot. Slowly and painfully they made their way up the stony incline until they stood beneath the high rock cliffs, and here again they crouched together, seeking what shelter they could behind a huge boulder, and thus they must have remained for some hours.

Meanwhile the party which had been left at the head of the slope, in obedience to orders, waited long for their absent leader, shouting again and again in the lulls of the whirling storm. At length they felt that something must be amiss, and that it was hopeless and dangerous to remain where they were. As usual on such occasions, the leading spirit came to the front, and the five who now remained submitted themselves to the guidance of Wild and followed him in single file as he again struck out for the direction in which they supposed the ship to lie. As they proceeded they found the slope growing steeper and the difficulty of foothold increased, especially for Vince, who was wearing fur boots, but they never doubted they would soon come to the bottom and find themselves in one of the valleys which would guide them to our winter quarters. In this manner they must have proceeded for about 500 yards, when their leader suddenly saw the precipice beneath his feet, and far below, through the wreathing snow, the sea. Another step would have taken him over the edge; he sprang back with a cry of warning, and those behind him, hearing it, dug their heels instinctively into the slippery surface, and with one exception all succeeded in stopping. What followed was over in an instant. Before his horror-stricken companions had time to think, poor Vince, unable to check himself with his soft fur boots, had shot from amongst them, flashed past the leader, and disappeared. It was difficult to discover from the men's account

exactly what happened after this catastrophe. In some sort of hazy way they seem to have realised that they must make upwards and away from the danger, and they started to ascend the slope.

All spoke of that ascent with horror, and wondered how it was ever accomplished. They could only hold themselves by the soles of their boots, and to fall or even to slip to their knees meant inevitably to slide backwards towards the certain fate below. Literally their lives depended on each foothold, and they possessed no implement to make these more secure. Of the party, Wild alone had previously armed the soles of his boots with a few light nails; this gave him a great advantage, and, to his great credit, he used it to go from one to another of his companions with a helping hand. As they crept laboriously upwards, the slope became steeper and more icy, but now, here and there, they found a stone which had rolled from the heights above and become firmly frozen in the icy surface. These afforded some anchorage and rest to the weary climbers. The storm still whirled the snow about them with unabated fury, but they pushed upwards in its teeth from stone to stone, until to their joy the stones grew thicker, and close above them they saw the black outline of the rocky summit. A final scramble, and they were once more on safe ground, with the nightmare of the climb behind them.

But their troubles were far from over, as they were still ignorant of the position of the ship. Wild again took the lead; the sea behind them must be north of the ship, he argued, and therefore they must keep the wind on their left front, and if possible keep always to the rocks. It is difficult in such circumstances to gauge time, and none of the party knew how long they walked on in dogged silence before their eyes fell on a well-remembered landmark, and cautiously descending a steep rocky incline, they saw the ship looming through

the grey whirl of snow; but between the breaking-up of their camp and the moment when they clambered over the side to make their report to me, six hours had elapsed. It is little wonder that after such an experience they should have been, as I have mentioned, both excited and tired.

The hours which followed the departure of Armitage and his search party on this fatal night were such as one could scarcely forget; exhausted as our returned wanderers were, we questioned them again and again to get greater light on the accident, but nothing could alter the fact that five of our small company were lost or wandering helplessly about in this dreadful storm. Hatefully conscious of my inability to help on account of my injured leg, my own mind seemed barren of all suggestion of further help which we might render; but, as was always my experience in the 'Discovery,' my companions were never wanting in resource. Dellbridge thought he could soon raise steam enough to blow the syren, and before long its shrill screams were echoing amongst the hills. Then, as we reconstructed the story of Vince's loss and pictured the cliff over which he had fallen, the bare possibility of some remaining fragment of sea-ice clinging below was suggested. Was it possible that we could reach it? The only possibility was by boat. Who would volunteer? Of course everyone. In ten minutes a whaler was swinging alongside and being rapidly loaded with provisions, cooking apparatus, and fur clothing; in ten more, with a picked crew of six men in charge of Shackleton, she disappeared around Hut Point.

Then we could do nothing but peer through the driving snow and wait. It was a trying time, and a full three hours elapsed before there was a hail from without, and through the drift appeared Ferrar leading three of the lost—Barne, Evans and Quartley. Ferrar's tale was soon

told. He had accompanied Armitage's party, and, guided by Wild, they had made for Castle Rock and eventually found the abandoned sledges, and, at first, nothing near them but two dogs cosily coiled up beneath the snow; but later, as they circled round on their ropes, they had providentially come on the three with whom he had returned. Armitage had picked him to return because his geological work had given him an exceptional knowledge of the locality.

An hour later the main search party returned; they had done all that men could do in such weather. A completer search was impossible, but it had to be admitted that the chance of seeing Hare or Vince again was very small. Soon after our whaler reappeared with her crew thoroughly exhausted; they had pulled easily whilst under the shelter of the nearer hills, but as they proceeded to the north they had come under the influence of heavy squalls which had driven them away from the land. It was only with the most strenuous exertion, and after hours of arduous struggling, that inch by inch they had gradually been able to regain the shelter of Hut Point, and so reach the ship.

As we prepared to snatch some few hours of rest after the anxieties of the night, we had sadly to realise the calamity that had befallen us in what appeared to be the certain loss of two of our comrades; but as the details of the story were unfolded, we could well appreciate that we had been almost miraculously preserved from a far greater tragedy. It seemed almost wonderful that the whole party had not disappeared, to leave us only the terrible discovery of the abandoned sledges or perhaps a frozen silent figure in the snow. Even now we could not clearly understand how the officer of the party and his two companions had been rescued; all were too dazed to complete their story on this woeful night. Later we learnt that after hours of crouching

beneath the boulder under Castle Rock, they had heard the faint shriek of the syren. It had revived their waning faculties, and they staggered once more to their feet to make towards the welcome sound, and thus it was that as they dragged themselves along they mercifully fell into the arms of our sledge party. All three were badly frost-bitten, and on the following day their ears, cheeks, and noses were swollen to a prodigious size; but as this meant a return of circulation, there was nothing worse for them in this respect than a great deal of pain and discomfort. But one of Barne's hands was in a much more serious condition; the blood obstinately refused to return to the dead white fingers, and, whilst he swathed them in well-greased bandages, the doctor informed me that there was little hope of saving them. For many days the prospect of amputation seemed imminent, and it was not until a week after the accident that the blood began to extend slowly and painfully towards the tips of the fingers. Although the hand was left in a shockingly mangled and painful condition, the fingers were saved.

It may be of interest to those whose fortune has not taken them to the colder regions of the earth to say a word or two concerning frost-bites.

Even in the coldest places it is necessary to keep one's face and sometimes one's fingers uncovered; consequently it is these parts of the body that are most likely to suffer, and in the Antarctic Regions we were all so frequently frost-bitten in them that we learnt to regard such an evil as part of the ordinary course of events: and indeed there was very little to fear as long as the frost-bite was noticed and the remedy taken in time. Under ordinary conditions one has a distinct sensation on being frost-bitten; the blood seems to recede from the veins in the exposed part with a suddenness that almost conveys the sound of a 'click'

and the feeling of a prick with a sharp instrument. At such times all that is necessary is to apply gentle warmth to the frost-bitten member. For instance, if one's cheek or nose is gone, one simply covers it for a minute or two with the palm of one's hand. There is a fiction that the best remedy is to seize a handful of snow and rub the offending member, but as the snow in the polar regions has the consistency of sharp sand or emery powder, the application of such a remedy would speedily remove the skin, with anything but a pleasant result.

Frost-bites such as I have described are merely superficial, and, as I have said, they were of such frequent occurrence that under ordinary conditions we learnt to regard them very little, and often, if one found it inconvenient to nurse one's own limb back to life, one called on the kindly offices of a neighbour.

But the frost-bites that come when people are doing hard work are more serious, as the first prick may pass unnoticed and the superficial freezing continues to take deeper hold without any further sensation Should the frost-bitten person be exhausted, the evil may spread with alarming rapidity, and then, too, limbs which are well covered and protected may be attacked, and the seriousness of such a condition needs no comment. Hence in our subsequent hard sledging work, whilst we treated the superficial frost-bite with scant respect, we learnt to be cautious to prevent the evil from becoming deep-seated. On long, tiring marches in a wind, frost-bites were bound to come frequently, and in nine cases out of ten were unfelt, so that our custom at such times was to pause occasionally and peer into each other's faces in search of white patches. More important still, we learnt not to continue exhausting marches too long in heavy weather, but to reserve a margin of energy for the chill work of making the camp, during which any

unduly tired person was bound to be in great danger of serious freezing.

A frost-bite must be very superficial and very quickly dealt with not to leave an after-effect. This effect is a blister, more or less painful in proportion to the seriousness of the frost-bite. To all intents and purposes the effect is precisely the same as that of a burn. In anything but a very superficial frost-bite, moreover, the actual sensation of returning circulation is very distinctly painful.

Places which have been frost-bitten become extraordinarily susceptible to a recurrence of the evil. In our second winter in the Antarctic there were few of us whose fingers had not 'gone' at one time or another, and consequently it was much rarer to see people working with bare hands than it was in the first winter, when many delighted to show their scorn of cold fingers. So for a long while after Barne had recovered the use of his hand he had to nurse it with far greater care than the uninjured one.

For the events which succeeded the distressing night of March 11 I draw on my diary:

'*March* 12.—Though the glass has risen continuously and uniformly, the wind has only grown steadier without diminishing, but there is very little of the driving snow which made last night so hideous. Another search party were out early under Wilson; they went well provided with ice-axes, rope, and crampons, and even thus had to use great care in venturing on the fatal slope where so much happened yesterday. They brought back the sledges and two more dogs, but could see no sign of the missing men. But indeed it would be beyond hope to find them alive after such a night; at least, we now know the worst. Some of the men are overwrought; twice to-day it has been reported that someone thought he saw a figure crawling down the hillside, and on one

occasion the illusion was so strong that two or three ran to the other side of the bay, only to find a boulder over which the drift was sweeping in fantastic curls.'

'*March* 13.—It is still blowing, and the temperature is $-6°$; but the air is clear, and, the glass having reached a maximum, there are hopes of a change for the better. We are raising steam, as I want to view the scene of the accident from the sea, and to make certain as to Vince's fate at least.'

Later I write: 'A very extraordinary thing has happened. At 10 A.M. a figure was seen descending the hillside. At first we thought it must be someone who had been for an early walk; but it was very soon seen that the figure was walking weakly, and, immediately after, the men who were working in the hut were seen streaming out towards it. In a minute or two we recognised the figure as that of young Hare, and in less than five he was on board. He was taken into the magnetic house, as it was thought unwise to take him into the full warmth of the living-quarters at once. We soon discovered that, though exhausted, weak, and hungry, he was in full possession of his faculties and quite free from frost-bites. He went placidly off to sleep whilst objecting to the inadequacy of a milk diet.'

It was much later that we learnt his story. It appears that he had left his companions intentionally, on finding that it was impossible to stand alone in his fur boots. He had shouted to the others that he meant to return to the sledges and change into leather boots, and he was under the impression that they had heard him and had quite understood the reason. He made the best of his way in the direction in which he supposed the sledges to be, but, as was natural, in the thick snowdrift he could see no sign of them. For long he wandered forward and backward, intent on his search; but gradually he got exhausted, and then he was conscious that his foot-

steps were aimless. The last thing he remembered was making towards a patch of rock, where he hoped to find some shelter from the raging wind. When he awoke this morning he found himself covered with snow, but, on raising himself on his elbow, he saw that he was on a slope under Castle Rock, and, glancing about him, recognised Crater Hill and other known eminences, and realised exactly where he was and the direction in which the ship lay. He started towards her, but found himself so stiff that for a long way he was obliged to crawl on hands and knees. But the stiffness wore off, and he was able to raise himself at length, and, with some rests, to reach the slope where we had first seen him.

'He must have lain under the snow for thirty-six hours, but it took a long time to persuade him of this; he found it hard to believe that this was the second day after the accident. I cannot but believe that his preservation is unique, and almost miraculous. The boy, who is only eighteeen, has been forty hours without food, and sixty without warm food; he must possess great stamina to have come through without hurt. The incident is also a tribute to our clothing. He was luckily wearing a heavy woollen blouse and complete gaberdine wind-covering over his warm underclothing. Unconsciously he withdrew his arms inside the blouse, and covered the opening in his thick helmet, and so saved his hands and face from freezing. The fur boots alone saved his feet from the same fate, and the snow, which rapidly covered him, must have done the rest. To-night his temperature has gone up to 100°, but he is otherwise quite well.

'In the afternoon we weighed our anchors and steamed round to the scene of the accident, when every detail of what we now call "Danger Slope" could be clearly seen. It is very steep for about 400 or 500 yards, and ends in a sheer drop into the sea. Though partly covered with

hard white snow, it has extensive patches of smooth bare ice; and, as the tracks of the various parties were worked out, it seemed more wonderful than ever that any should have escaped to tell the tale.

'Every incident could now be closely followed, and all shadow of doubt as to Vince's fate is gone. At least, we have the satisfaction of knowing that nothing could have been done either by his own party or by those on board to have averted it.'

We had now finally and sadly to resign ourselves to the loss of our shipmate, and the thought was grievous to all. From the moment when he joined us at the Cape of Good Hope, Vince had been popular with all; always obliging and always cheerful, I learnt that he had never shown these qualities more markedly than during the short sledge journey which brought him to his untimely end. His pleasant face and ready wit served to dispel the thought of hardship and difficulty to the end. Life was a bright thing to him, and it is something to think that death must have come quickly in the grip of that icy sea.

CHAPTER VII

PREPARING FOR WINTER

Delay in Freezing-up of the Ship—Dog Troubles—Return of Royds—Local Weather Conditions—Last Sledging Effort of the Season—Advantage of Experience—Preparing for Winter—Winter Arriving—Meteorological Screen—Tidal Observations—Magnetic Huts—Capturing Crab-eaters—Emperor Penguin Hunt—Departure of the Sun.

> Experience be a jewel that we have
> Purchased at an infinite rate.—SHAKESPEARE.

OF late the temperature had crept steadily down and the young ice seemed more and more reluctant to yield to the blustering winds and quit the surface of the strait. Our short voyage to 'Danger Slope' was made through patches of sludgy, sodden ice which were even then increasing in thickness. As we dropped our anchors again in our small bay we felt that it was for the last time before the winter closed in on us, and that soon further movement would be impossible; indeed, the only wonder was that such conditions had not come long before. But now the wind alone kept the water open, and in the short intervals of calm the icy crust formed with great rapidity. I was anxious to be frozen in with our bow pointing out to sea, and with the ship at such a distance from the ice-foot that she should run no chance of being pressed against it; but as the wind always blew out of the bay, this was not easily accomplished, and we had to content ourselves with

being ready to turn her at the critical moment. For this purpose anchors were bedded on the ice-foot, and wire hawsers attached to them ready to haul the stern round when the wind permitted it. In the meantime we could only get to the shore by means of boats, and when the wind grew very strong our communication was interrupted altogether, since under such circumstances we scarcely liked to send a boat away, for fear it should be carried out to sea by some more than usually fierce gust.

It was for this reason that we were impotent to prevent the murder of two of our dog team, though we actually witnessed it, and bitterly regretted the incautious but kindly policy which had allowed these animals to run free, when they should have been chained up.

Here, again, we erred from want of experience. The dogs had been particularly quiet of late; each had his own kennel, and his own bountiful supply of food; they had been given plenty of exercise and were allowed to run about at their own sweet will; there seemed to be absolutely nothing that they could quarrel about, and for days they had lulled us into false security by appearing to be quite contented and to be living on the most amicable terms. But alas for dog morals! As we well understood when we knew them better, they were only biding their time. Some of their number had been away sledging; why should they have been chosen? What treats and petting had they been receiving from the hands of man that by right belonged to the whole community?

They were objects of suspicion. Nothing they could do was quite right; it was no use their wagging their tails and pretending to be friendly when they had played a low-down game like that! it was all mere impertinent deception! One can only suppose that such thoughts pass through the doggish mind, because the result is

always the same. Let a dog be unduly petted or receive more than his share of food, or be taken away sledging: he inevitably becomes an object of suspicion to the rest. The first growl, the first step beyond the rigid limits of propriety, and not one, but the whole pack are upon him, and even the thickest coat is a poor protection against those bloodthirsty fangs. Of course there are exceptions; here and there is a dog of such commanding temper or such truculent demeanour that he can afford to be treated differently from the rest; but even he seems to have to silence criticism by being more than usually aggressive, if he should have been absent for any length of time. Such a dog becomes the natural leader of the pack; he is unceasingly watchful; he never pauses to parley, but attacks at the first sign of insolence, for he knows well that the sharpest and quickest fang commands the situation.

These revelations of dog nature came to us gradually. It was on March 15, whilst we were cut off from the shore, and were casually watching the dogs as they idly trotted about on the snow, that we witnessed the first attack. There was a growl, a wild rush to a central spot, a heap of heaving, snarling forms, and the horrid deed was done, almost before we realised that the peace had been disturbed. We shouted and whistled, but might just as well have held our breath. The deed done, peace once more prevailed, and one would scarcely have imagined that anything had happened but for the stiff, lifeless form on the snow.

On the following day the wind still blew hard. We had determined, however, that we must risk the passage to get these bloodthirsty wretches chained up; but even whilst the boat was being manned the last night's tragedy was re-enacted, and another poor beast lay mangled on the ice-foot. As the boat's crew landed, the murderers welcomed them as though nothing out

of the ordinary had happened, and with a few exceptions they were easily caught and chained up. Then, one by one, they were led out and severely chastised in front of their victims. The punishment helped to relieve our righteous indignation, but otherwise, I think, we might have spared our energy again, for the dogs evidently didn't know what it was all about. You cannot change dog nature.

Meanwhile, however, we had lost two good sledge dogs, which we could ill afford, and we decided that, however trying it might be to their feelings, the remaining animals must be kept on their chains. As we expected, the victims proved to be two harmless, quiet animals which had recently returned from sledging.

The fatal mishap which had attended the main portion of our first sledge party left us in some anxiety for the remaining members who were still absent. We knew them to be ill provided for very severe conditions, and saw already that sledging in the Antarctic was not a thing to be approached in a light-hearted, irresponsible spirit, but was one which called for great care, attention, and forethought. Our anxiety for the absentees was not lessened when we saw Skelton descending the hills alone on the 19th. However, when he was safely on board we learnt that he was only a forerunner, and that the others were close behind; and soon they appeared, and in turn were ferried off to the ship. There was much to be learnt on both sides: it was for us to tell the sad tale of the recent disaster, and for them to set forth the incidents and difficulties of their attempt to reach the *Record* cairn. Royds' report was so laconic that extracts from it may well convey an idea of the troubles which beset the inexperienced sledge traveller:

'*March* 4.— . . . On the summit "Nigger" bit "Gus" so badly through the mouth that I had to send the latter back. . . . 6.0. Stopped for tea, erected

two tents; Barne's ear frost-bitten, several men had cramp in left leg, myself very bad. . . . On starting again Vince and I had frost-bites under the nose. Dogs pulled well; some fights and a little trouble; "Boss" ran away. 8.15. Camped. Dogs wouldn't eat anything; one sledging lamp broken—a great nuisance, as now one lamp has to cook for six men. Cramp prevalent amongst all hands.

'*March* 5.—Very heavy going. Quartley's foot giving much pain. Got up tent and had it examined. Not frost-bitten, but intensely cold; made him wear fur boots. . . . Several dogs got bleeding feet; snow getting heavier; all hands perspiring very much, feet sinking 9 inches to 1 foot at every step. . . . 5.45. Men completely "cooked," dogs tired out; so camped.

'*March* 6.— . . . Snow getting thicker and softer, and steered towards the land hoping for better conditions. . . . Barne's dogs lying down and refusing work. . . . Find it best for sledges to run on fresh snow, and not over footmarks. . . . 6.50. Forced to call a halt; men and dogs completely done. The dogs' feet give them a lot of trouble; they lick them hard at every halt. Several men have cramp; we feel back muscles and legs awfully. Weller was so done when we stopped that he flopped across the sledge and broke the sling thermometer. . . . Made good only four miles. . . .'

This, with more to the same effect, goes to show that the party were doing a great deal of hard work without much result. By steering towards the land they only got into softer and deeper snow, and therefore it was little to be wondered at that on the 8th Royds decided to divide the party and to attempt a further advance with Mr. Skelton and Dr. Koettlitz, who, besides himself, were alone provided with ski. By this time they were almost beneath the steep cliffs which fringe the

southern snow-slopes of Mount Terror. The level plain had given place to long, steep undulations formed by the pressure of the land-ice, and the silence about them was repeatedly broken by the thunderous roar of an avalanche. On the 9th the three officers set out on their ski, and with only one light sledge behind them made much better progress until, getting towards the eastern slopes of Terror, they again found themselves on a hard, wind-swept snow surface. They had still some miles to go before they came to the junction of the barrier edge with the land, and the calm weather which they had hitherto enjoyed now deserted them, making it most difficult in the drifting snow to see their exact whereabouts or the nature of the snow conditions about them. Skirting the slopes of the mountain, however, they pushed on until they were forced to rise on a snow incline which came abruptly to an end and was succeeded by long stretches of bare land over which it was impossible to take the sledge. Here they made their camp, and from it they could see the open Ross Sea and the confused hummocked ice of the barrier where it forces its way around the land. The penguin rookery in which our record had been placed was still some distance from them, as they knew, and they remembered that the north-eastern side of the mountain was so free from snow that there could be nothing now but bare land between them and it.

But this bare mountain-side was extensive, and covered so thickly with small volcanic craters that it was difficult to select the best path for their walk to the rookery, or, within limits, to estimate their distance from it. There was risk also, in a country where one landmark was so much like another, that on their return they might have great difficulty in finding their camp; and if the wind should rise during their absence this risk would be greatly increased, so that they ran the chance

of being landed in a very sorry plight. In fact, at their first attempt on March 13, they had barely gone half a mile from the camp when a thick blizzard came on, and they only regained their tent by luckily falling across their ski, which had been planted at some distance from the camp as a possible guide.

On the following day, however, they again sallied out and succeeded in getting some miles towards their goal, if not actually above it, before the wind came on and, blotting out all features of the landscape with snowdrift, obliged them to turn back and seek shelter with all possible speed.

It was now evident that the *Record* post could be reached, but a fine day was essential, and here, as elsewhere, small matters of detail connected with the special circumstances must be attended to. One could not conveniently climb over sharp, jagged rocks in the foot-gear which was worn with comfort on the snow plains, as the bruised, sore feet of the party witnessed; another time it would be necessary to come properly prepared with some arrangement for protecting the sole of the foot.

The attempt to reach the *Record* was finally abandoned on the 15th; but not until it was evident that a better-equipped party with more favourable weather would have no difficulty in getting to it. It will be understood that it presented itself to me as a most important matter that this record should be reached, as here lay the only chance of communicating our position to any who should follow in our footsteps, but it was immaterial whether it was reached now or after the coming winter; the assurance that it could be reached was the comforting fact that this party discovered, and in any case a spring expedition would have been necessary to bring the news up to date.

No sooner had the party turned towards the ship than the wind fell, and with it the temperature. It was something to know that the wind which had swept past this

corner throughout their stay was not perpetual, but the rapid fall of the thermometer found them ill prepared. It had not occurred to any one that within such a short distance of the ship there might be any large difference of temperature, and as the summer was barely over, the officers had provided themselves with a light wolf-skin fur suit only, for night wear. They had found this clothing all too meagre when the thermometer stood at $-10°$ or $-15°$, but on the night of the 16th sleep proved impossible, and for the first time they found themselves subjected to uncontrollable paroxysms of shivering. Huddle together as they might, they could get no warmth, and on creeping out to consult the thermometer they found it had fallen to $-42°$. They were luckily able to boil some cocoa, and thus to get some warmth into their chilled bodies, but as the long sleepless hours crept by they had ample opportunities of learning the value of adequate clothing, and the wisdom of being prepared for the unexpected rigours of a fickle climate.

With the morning the cold snap ended, and three days later they reached the ship without further adventure.

On comparing notes with this party we realised for the first time what a difference there might be in the weather conditions of places within easy reach of the ship. It was not only in the matter of temperatures, as I have already described, but also in the force and direction of the wind. On the 17th at the ship we had had a very strong blow from the south, at one time rising in force to a full gale, but the party only some twelve miles to the eastward had felt nothing of this; with them the day had been calm though overcast. This difference of weather conditions could be observed throughout the journey; neither those on board nor those away could have told from their own meteorological conditions what the weather might be with the others, and this fact was again and again impressed on us throughout our stay in this

region. Already we had learnt that the prevalent wind at our winter quarters blew from the S.E. through the 'Gap,' and that this wind was usually local and frequently ceased within a mile or two of the ship. To this we could now add some further conclusions. It was evident that the eastern slopes of Terror were terribly wind-swept, and that there the prevalent direction was from the south, whilst the deep bay immediately to the eastward of our peninsula was a particularly windless area where the snow lay thick and soft, and was only occasionally stirred by whirling squalls.

Meanwhile the position of the ship towards the latter end of March was anything but satisfactory; that the temperature should have fallen to $-40°$ to the eastward was a clear sign that the winter conditions were upon us, but although the ice forming about us sometimes reached a thickness of two or three inches the sheet never held for any length of time, but broke up rapidly when the wind grew strong. Under these conditions it became increasingly difficult to keep up communication with the shore; when it was not blowing a stiff gale our boats had to force their way through a tough elastic sheet of young ice, which clung to the sides in the most exasperating fashion, and sometimes the short passage could only be made after much hauling on ropes and the systematic use of poles to break up and thrust aside the sheet. On one occasion our light skiff was brought to a stop halfway across in such a manner that the crew could neither advance nor retreat, and it was quite an hour before, by manning a heavier boat, we were able to break a way through and free her.

In this wholly unexpected state of affairs at such an advanced date there were many drawbacks. Until we were solidly frozen in, the security of our position must be doubtful; economy of coal had long ago necessitated the extinction of fires in the boilers, and should a heavy

gale drive us from our shelter we could only have raised steam with difficulty and after the lapse of many hours. If driven off by such a gale, should we be able to get back? It seemed doubtful, and meanwhile it would certainly be unsafe to send a large party away from the ship, because with the ship adrift it was obvious that most of them would be needed. If, on the other hand, the fates were going to allow us to remain in this spot, there was much to be done in preparing for the winter; especially it was desirable that the engines should be taken to pieces and the steam joints be broken before the severer cold came upon us; but in our present position we dared not attempt such work. One of the most annoying circumstances was that until we had a solid sheet of ice about us we could not set up our meteorological screen, nor communicate regularly with the magnetic huts, nor, in fact, properly carry out any of the routine scientific work which was such an important object of the expedition.

Our proposed winter station was so far beyond that of any former expedition that, as I have already pointed out, we had nothing to guide us as to what the winter climate might be, and our astonishment at the prolonged open conditions left us almost in doubt as to whether the sea was ever going to freeze over satisfactorily. The breaking away of the old ice had ceased, and the open water was now at its maximum for the season; as will be seen from the chart, it ran from the decayed glacier tongue, which we had visited on February 8, to the S.E., circling about Cape Armitage with a radius of four or five miles, and forming a deep bay to the eastward of the peninsula. The ice-edge which limited the open water could be seen very distinctly from the hills in the vicinity of the ship—a long, irregular ribbon of white, gradually circling round, the edge itself standing in some places two or three feet and in others ten or fifteen feet above the sea level, and

showing that what remained was ice of a different character from that which had broken away, and constituted the limit of a more ancient ice-sheet.

At this time I was anxious to make one more sledging effort before the winter set in. The ostensible reason was to lay out a depot of provisions to the south in preparation for the following spring, but a more serious purpose was to give myself and others a practical insight into the difficulties of sledge travelling. One saw already that a great deal of our sledging outfit was unsuitable and would have to be rearranged; one saw, too, that in the minor details of clothing and so forth there were points on which there was much difference of opinion, and with regard to which, therefore, it was desirable that every man should fend for himself, providing for things as best suited his own ideas; above all, it was evident that in a sledging campaign, as in any other, the best work would be done by the trained man. Before us lay the long winter with ample time to organise our parties and to make the most detailed preparations, but one could not hope to do this without a full knowledge of the conditions to be met and a ready and intelligent co-operation amongst all who were engaged in the work. My wish, therefore, was to make a final autumnal expedition which should include all those who had not been away already; but as this included the majority on board, we were forced to await the greater security of the ship, not only for reasons which I have already mentioned, but also because until the deep bay to the south became re-frozen we could only travel in that direction by the most circuitous and difficult route. When the ice became safe, the simplest way lay around the cape; failing this, we could manage without much difficulty to get through the 'Gap'; but if the sea-ice opposite that was unsound, we should have been forced to climb to a height of nearly 1,000 feet, and after descending on the other side to traverse a number of high, broken ridges.

The freezing-in of the 'Discovery' was a very gradual process. The ship, secured by her stern hawsers, had held in place a small wedge of ice which had formed in the corner of the bay. On March 24 this small patch was strong enough to bear, and whilst the bow of the ship was in open water, for the first time we were able to walk on shore from the stern; and this wedge of ice held, and gradually increased in thickness, in spite of the strong breezes of the week which followed.

For instance, on March 27 I write: 'Blowing with – 10° temperature during forenoon, but quite fine in afternoon and evening. Our ice, having held during the late wind, may fairly be considered to have come to stay. At 4.30 a party of us went over the hill through the "Gap" to investigate the chance of getting sledges down by that route. We found the sea frozen over, and evidently, from the snowfall on it, the ice has been formed for several days. It looks firm and hard, but there is a drop of eleven feet from the ice-foot, which will be a difficulty for the sledges, but will save the necessity of going round by the seal crack. Nothing could exceed the beauty of the scene this afternoon; the snow was bathed in rosy light, gorgeous shafts of gold sprang up from the sun, and the sky was blood-red behind the hills in its wake. The moon was up, a vast yellow disc to the east. It will be a companion for at least the first part of our journey. Now and again, as we trod on the snow-covered slopes of the hillsides, the icy crust cracked with a sharp report like a pistol-shot. Evidently it is in high tension from the recent cold.'

'*March* 28 (*Good Friday*).—The day has been beautifully calm and bright, though the temperature has not risen above – 4°. After service our people spent the day wandering over the hills; it was quite pleasant to see little parties dotted about here and there, with a dog or two for company. The sea is at last frozen over, and if

this weather lasts the ice should become firm enough to withstand future gales. We have completed the packing of our sledges, though I cannot say I am pleased with their appearance; the packing is not neat enough, and we haven't yet got anything like a system. To-morrow, if the weather holds, we take our sledges across to the other side, so as to make a fair start on Monday.'

'*March* 30 (*Easter Sunday*).—Like yesterday, a fine day, with a light northerly breeze. This is a season of flowers, and behold! they have sprung up about us as by magic: very beautiful ice-flowers, waxen white in the shadow, but radiant with prismatic colours where the sunrays light on their delicate petals. It was a phenomenon to be expected in the newly frozen sea, but it is curious that they should come to their greatest perfection on this particular day. The ice is about five inches thick and free from snow; consequently the ice-flowers stand up clear-cut and perfect in form. In some places they occur thickly, with broad, delicate, feathery leaves; in others the dark, clear ice surface is visible with only an occasional plant on it; in others, again, the plants assume a spiky appearance, being formed of innumerable small spicules. The more nearly one examines these beautiful formations, the more wonderful they appear, as it is only by close inspection that the mathematical precision of the delicate tracery can be observed. It is now established that on the freezing of salt water much of the brine is mechanically excluded. Sea-ice is much less salt than the sea itself, and what salt remains is supposed only to be entangled in the frozen water. The amount of salt excluded seems to depend on the rate at which the ice is formed, and whilst some is excluded below the ice-surface, some is also pushed out above, and it is this that forms the ice-flowers. The subject is very fascinating, and we have already started to measure the salinity of ice taken from different depths and formed under various conditions:

the ice-flowers themselves do not seem to constitute a saturated solution of brine, and why they should differ in form in various places seems beyond explanation.

'To-day we saw a group of penguins far over the ice, and after church Hodgson, Shackleton, and I walked out towards them. They turned out to be Emperors, and were all standing about very contentedly near a crack much too narrow to allow them to get through. It is difficult to see how these birds can now get north, and it looks as though they winter more or less in these regions, probably close to spots where the ice is certain to open from the effect of tide or wind. If so, this would throw a new and interesting light on their habits, and one can only hope that they will give us the pleasure of their company in our immediate vicinity.

'To-night as I was walking back from the hills I was frost-bitten in the lobe of the ear. I describe it because it was a typical example. There was very little wind, and as I came down the slope I distinctly heard or felt a sort of snap in my ear, but, feeling nothing, I paid no heed until when I got on board I realised that I had no feeling in the ear. It very quickly thawed out—much too quickly, in fact; for now it is swelled up to a great size, and there will be no escaping the coming blister.'

On the following day we made our start, a party of twelve, divided into two teams, each with a string of sledges and nine dogs. A strong south-easterly wind with snow-drift was pouring through the 'Gap,' but a mile or two to the south we got clear of this and plodded on in comparative calm. Our loads were arranged theoretically, 200 lbs. to each man and 100 lbs. to each dog, and the first discovery we made was that the dogs entirely refused to work on our theory; the best of them only exerted a pull of about 50 lbs., and this with very dispirited and downcast mien; the rest hung disconsolately back on the traces and had to be half led, half dragged over the frozen

surface. The whole thing was extremely troublesome, and, what with the heavy pulling and the constant necessity of clearing the traces, as may be imagined, our progress was extremely slow, and we heartily wished we had left the whole dog team safely chained up. It was a curious reversal of our expectations. I don't know that we had any very good reason, but we had never thought but that our dogs, when they got the chance, would be found straining at their traces with heads and tails held high. To see them now with both ends at the maximum depression was a severe shock to our inexperience.

We learnt later on that it was a bad plan to combine dogs and men on a sledge; the dogs have a pace and a manner of pulling of their own, and neither of these is adapted to the unequal movement caused by the swing of marching men. Both men and dogs like a light load, but the former are much less easily dispirited by a heavy one.

But on this occasion there was a stronger reason for the inefficiency of the dogs. They were losing their coats; the thick fur was coming out in handfuls, and the young downy coat underneath formed a wretched protection against the bitterly cold winds that headed us. The habits of the animals were of course adapted to their northern home, where at this time the warm summer would be just commencing and where no doubt they would have been glad enough to be free of their thick winter garment; but that Nature should oblige them to discard it at the same season in this hemisphere was obviously ill-timed. As a matter of fact, our poor dogs suffered a great deal from their poorly clothed condition during the next week or two, and we could do little to help them; but Nature seemed to realise the mistake, and came quickly to the rescue: the new coats grew surprisingly fast, and before the winter had really settled down on us all the animals

were again enveloped in their normally thick woolly covering. It may here be remarked that they moulted again in the spring; what would have happened in the following autumn cannot be said, for by that time, alas! all our team had ceased to be; but it seems as though they were already adapted to their new environment.

The fact that the dogs refused to do their share of the work on this trip meant of course that we had to do a good deal more than ours, and the resultant load per man was a great deal more than we ever afterwards sought to inflict on a party. We were practically doomed to failure, but each hour was an invaluable experience. On the first day we had already travelled some way over the new sea-ice when we realised that we must cross it before camping, as on it we could get no snow, either to fill our cookers or to secure our tents. This meant a long pull, and the night fell on us as we struggled with all the unaccustomed details of pitching camp. The thermometer fell to $-40°$ before we could climb into our ill-made fur clothing, and the hours which followed were comfortless enough to have discouraged the most ardent sledger. For two more days we pushed on in the same disorganised fashion, the men straining hard at a heart-breaking load, the dogs at each step flinching more determinedly from the cutting wind and the light pricking drift which it carried to the level of their noses; the thermometer never rose above $-30°$, and the third night it fell to $-47°$. The daylight hours were now very short, and all too many were wasted in the unavoidable delays of inexperienced camp work, and from the want of facility in the details of our arrangements. After three days' labour we were only nine miles from the ship, and it was quite evident that under present conditions we could not expect a better speed. On April 3 I decided to turn, and 'caching' our heavy loads we reached the ship that night, and could then fully realise what an extraordinarily sheltered position she occupied,

for I find in my diary: 'The temperature on board has never fallen below $-23°$, so that it appears we can count on about 20° better in our snug winter quarters than occurs on the open barrier. But if one can get nearly $-50°$ on the barrier before the sun has set, what is it going to be like in mid-winter? and what also in the early spring, when our sledging begins again?'

Our autumn sledging was at an end, and left me with much food for thought. In one way or another each journey had been a failure; we had little or nothing to show for our labours. The errors were patent; food, clothing, everything was wrong, the whole system was bad. It was clear that there would have to be a thorough reorganisation before the spring, and it was well to think that before us lay a long winter in which this might be effected.

I have described these early troubles in some detail, partly because they show how much we learnt by our failures and partly because it is necessary to realise that sledging is not such an easy matter as might be imagined.

That we were eventually able to make long and successful sledge journeys is no doubt due to the mistakes which we made and to the experience which we gained during the first barren attempts of this autumn, and yet more to the fact that we resolved to profit by them, and thoroughly took our lesson to heart. I do not mean to imply that our education was complete—as a matter of fact, we never ceased to learn new tips or to adopt new devices, and the general sledging work of the second summer was vastly superior to that of the first—but it was the crushing ineffectiveness of our early efforts which taught us the first great lesson.

The daylight hours were now getting rapidly shorter, and we knew that before the end of the month we should lose the sun. We were left with little time to complete all our outside arrangements, which had been necessarily

delayed until the formation of the ice-sheet; although we felt anything but certain that the ice had come to stay, the losses which its break-up would entail must now be risked.

One of our first cares was to get up the meteorological screen; this erection, made under the superintendence of our meteorologist, Mr. Royds, consisted of a framework supported by four stout poles; special louvred box-screens were placed high on this, and inside them were fitted the various thermometric and hygrometric instruments, whilst the corner poles were utilised for anemometers and wind vane. The whole of this somewhat elaborate erection was placed about 100 yards astern of the ship, and consequently in a direction which would be to windward of her with the prevalent south-easterly winds. At first the actual screens were some eight feet above the surface of the ice, but we soon found that our small bay was a focus for driving snow, and after each storm the surface was raised a foot or more and the comparative height of the screens proportionately reduced; once the whole structure had to be dug up and moved for this reason, but this could not be repeated often, and the net result was that the screens were reduced to an average height of five or six feet above the surface. We found it was quite time that these screens were placed, as we were getting very inaccurate temperature readings on board; for instance, I find a note of one comparison made about this time: 'The thermometer on the gunwale shows $-20°$, that in the screen on board 4° higher, and that in the screen on the ice some 5° or 6° lower.'

We possessed one recording anemometer of the 'Dyne' type. The instrument itself had to be placed in shelter, and we allotted one of our small deck-houses to it. The funnel vane was secured in the mizzen cross-trees, some forty or fifty feet above the deck, and two small lead pipes connected it to the recording instrument. Finally,

the barometer was placed in the magnetic deck-house and the barographs in suitable positions close by.

To obtain a complete record of meteorological observations was one of the most important scientific objects of the expedition, and it had been decided that the instruments should be read and recorded every two hours. And so in calm or storm, night and day, some member of our community had to be on the alert and every other hour to make the rounds of the various instruments. First the barometer would be visited, its reading and that of the attached thermometer registered; then at the screen the readings of the wet and dry bulb thermometers and of the minimum thermometer would be noted; then the anemometers and the wind direction had to be observed; then an estimate made of the force of the wind and notes added concerning the nature, amount, and direction of movement of the clouds; and, finally, the various recording instruments must be visited to see that they continued in good order. On a fine night this was no great hardship, but in stormy weather the task was not coveted by anyone. On such occasions it was necessary before going out to prepare oneself carefully to resist the wind and snowdrift, and the round itself was often attended with exasperating annoyances. During the winter it was always necessary to carry a lantern, but it is not easy to construct a lantern which will remain alight in all conditions of weather. At first we tried a small electric glow-lamp, but batteries and leads so easily got out of order that this was abandoned. Finally a candle lantern was evolved which was fairly satisfactory, but in the meanwhile many a time was the hapless observer forced to desist in the middle of his work to return and obtain a fresh light. The necessity of writing up the record sheet in the open was also trying in windy, cold weather; not only would one's fingers freeze very rapidly, but one's breath would form

an icy film on the paper through which it was difficult to make the pencil-mark. The most annoying instrument with which we had to deal was called the Ashmann's aspirator; it consisted of a wet and dry bulb thermometer, but the air was circulated around the bulbs by a clockwork fan. At each observation it was necessary to wind up the clockwork, to wait for the fan to have full time for action, and then to read the result on two distressingly thin threads of mercury. As all these operations had to be done with bare fingers, a more angering cold weather instrument can hardly be imagined.

The trials and tribulations of the meteorological observer were, in fact, numerous, and it was arranged that throughout the winter each officer should take it in turn to make the night observations from 10 P.M. to 6 A.M. Dr. Wilson nobly offered to take the 8 A.M. observation regularly, but the lion's share of the work fell on the meteorologist himself, who, besides taking his share of the night work, throughout the first winter and a great part of the second, took all the observations between 10 A.M. and 10 P.M.

The most dreaded day for Mr. Royds, however, was Monday, as on that day it became necessary to change the papers on the recording instruments. Anyone who is familiar with the ordinary barograph or thermograph can imagine that when the temperature was below −20°, with a brisk wind, this task could appear attractive to no one.

I may remark generally that it is quite a mistake to suppose that one grows hardened or more callous to the cold, either in one's fingers or in any other part of the body; what does happen, however, is that one becomes more expert in keeping oneself warm. For instance, in handling cold metal one learns when to stop and to plunge one's fingers back into a warm mit, and how best

to restore one's circulation; and so in the long run, when a cold job has to be done, it is done more expeditiously and with less suffering after experience has been gained.

Before quitting the subject of meteorology I may say that other observations were added as we gradually came to see our way more clearly and took our winter walks abroad. One had only to walk a few hundred yards from the ship to get sight of the smoking summit of Erebus, and we soon saw that the direction of movement of its vapour afforded us the most excellent indication of the upper air currents, and few days passed without some recorded observation of this fine beacon.

Later, too, our energetic walkers established subsidiary observatories where the temperatures could be taken and compared with those read near the ship. We were thus able to get interesting comparisons with observations taken on the top of the highest hill in our neighbourhood, 1,080 feet above us, and with a spot on the other side of Cape Armitage, and therefore more directly affected by the barrier conditions.

Another routine observation I was anxious to get into working order was that of the tide, and here we were faced with a good deal of difficulty in attempting to make a gauge which would work successfully through the ice. We had endeavoured to get some observations before the sea froze over, but the long pole which we placed against the ice-foot soon became so crusted with ice that the markings were obscured, and as it was impossible to clear this ice except from a boat, we were not able to get continuous readings. But later on we succeeded in getting a continuous record over a long period; and as the arrangement was only arrived at after some thought and numerous trials, the method is worth description for the benefit of future explorers who may be similarly situated.

Our first essay was to take a length of the single piano-

forte sounding-wire, of which we carried a great quantity. One end of this was attached to a heavy weight resting on the bottom; the wire was then taken through a block held up by means of a tripod firmly planted on the ice, and to its other end was attached a second weight having about half the mass of the first. It is evident that with such an arrangement, as the tripod rose and fell with the tide, the upper weight would record its movement, always providing that the wire did not become too firmly gripped by the ice. As the wire was strong enough to admit of comparatively heavy weights, I had hopes that the pull would always be sufficient to overcome the friction of the ice, and for a long time this was so; but at length the ice became thick enough to hold the wire, and then of course the arrangement failed.

We had already improved on the tripod, by fixing up a second gauge working over the ship's side, with the second weight inside, when this difficulty arose. The problem now was, how to get the wire to work freely through the ice, and it was solved in a very simple manner. Someone—I think it was Wilson—conceived the brilliant idea of surrounding the wire with paraffin, which does not freeze, and our excellent engineers had soon turned out a small copper tube more than eight feet in length. The new tide-gauge was quickly completed; the wire was now brought up through a small wooden plug at the bottom of the tube, then through the tube and up over a freely working pulley which hung from the forecastle, through another pulley on the deck, and down to the inside weight, which hung opposite a well-marked scale. When the copper tube, filled with paraffin, was firmly frozen in the ice, we had the satisfaction of seeing the wire working through it practically without friction, and this it continued to do throughout the winter and spring. In searching for possible causes of error, we had, of course, to assure ourselves that the

ship rose and fell regularly with the surface of the water, and to make allowance for any alteration in trim which might take place from time to time; but, with all its advantages and disadvantages, the arrangement must be considered about as satisfactory a one as could well be arrived at in the circumstances.

I have given some account of the erection of our magnetic huts. It would perhaps be as well to give here an idea of the purpose for which they were used. They and all that appertained to them were Mr. Bernacchi's special business, and many times a day this officer could be seen journeying to and fro in attendance on his precious charge. Within the larger of the huts, mounted on a solidly bedded oak plant, could be seen three small instruments, set at different angles, but each containing a delicately suspended magnetic needle to which was attached a tiny mirror; a shaded lamp and a roll of sensitised photographic paper were so arranged that the light reflected from each small mirror was thrown on to the roll, and the latter was slowly but continuously revolved by clockwork. The sensitised paper came off the roll in long strips, and after being developed exhibited fine wavy lines drawn by the points of light focussed from the mirrors. The three small instruments recorded respectively the declination, horizontal force, and vertical force, or the elements of the earth's magnetic pull from which its nature could be calculated at any moment.

The general reader may well wonder why so much trouble should be taken to ascertain small differences in the earth's magnetism, and he could scarcely be answered in a few words. Broadly speaking, the earth is a magnet, and its magnetism is constantly changi
is a magnet, or why it changes, or indeed what magnetism may be, is unknown, and obviously the most hopeful road to the explanation of a phenomenon is to study it. For many reasons the phenomenon of magnetism could

be recorded in few more useful places than our winter station in the Antarctic.

These record strips were a source of great interest to us all when Bernacchi showed them from time to time. They varied much in character; sometimes the lines would run with long gradual waves, at others they were distinctly jerky and unsettled, and occasionally there were magnetic storms, when they would fly off the paper altogether. There was a fourth line, which I have not yet mentioned; this was the line of temperature, and was necessary for the correction of the others. It was this that gave Bernacchi most of his trouble and drew to an alarming extent on our oil supply. The desire was to keep a constant temperature inside the hut, but with the frequent change outside this was most difficult to do, and although attempts were made to regulate the burning of a heating lamp within, the variations were at first very great, though they were lessened when we could get a sufficient supply of soft snow to bank the house up thoroughly outside.

Besides the magnetic variometers the larger hut contained another instrument of importance in the seismograph, which also kept a continuous record on a long roll of sensitised paper. I do not know that we had any good reason for so thinking, but, situated so close to an active volcano, we had expected this instrument to show much activity; contrary to our expectation, however, our region proved a particularly quiet one, and throughout our stay we were singularly free from earth tremors.

It should be understood that the magnetic instruments which I have briefly mentioned above were purely differential instruments. Whilst they would faithfully record the changes from hour to hour and day to day they were liable to small derangements which might prevent the comparison of one month with another. To obviate

this difficulty, from time to time check observations were taken with absolute instruments, and for this purpose the second and smaller hut had been provided. In this small, dark cabin Bernacchi would occasionally be forced to shut himself, with only the magnetometer and the cold for company.

In addition to the establishment of the routine of regular scientific work, there was a great deal of work to be done for the comfort and well-being of the ship before the winter set in, and this, together with many unexpected tasks, kept all hands busy and amused. The incidents of this time are perhaps best given in extracts from my diary:

'*April* 5.—Some seals were observed close to the cape this afternoon; a killing party managed to get six. The skua gulls have gone, so that the carcases can now be left about with safety. Except for this reason, we rather miss the skuas; the absence of bird life adds to the deserted appearance of our outlook. There is still a slight swell, most noticeable at the crack beyond Hut Point; from the Point and from Cape Armitage there are numerous radial cracks, gradually widening and extending in length. Two "crab-eater" seals were found on the ice close to the ship to-night; we have very rarely seen these seals since our arrival in winter quarters; they seem to live mostly in the open sea. These animals must have come up through one of the holes, and then, possibly attracted by the ship, they appeared to have lost their bearings, as they crawled in any direction rather than towards an opening in the ice.

'We were still desirous of increasing our stock of seal-meat, but had we killed these animals at once we should have had great difficulty in skinning them in the dark, and by morning we knew the carcases would be hard frozen. In this dilemma orders were given to tie them up, and this resulted in quite an amusing scene. This

species of seal is much more lithe and agile than the Weddell, and no sooner had a noose been cunningly drawn around the neck of one of these animals than he whipped round with such a ferocious snapping of the jaws that the holder of the rope incontinently fled; at length double nooses were drawn tight under the flippers of each animal, and with a precautionary extra rope around the tail we had them, as we thought, securely tied to the ship's chain cables; but ten minutes later we heard that both had freed themselves by slipping through their lashings. By this time everyone was turning in, but the matter was now growing into a serious reflection on our ability; that a party of sailors should confess themselves unable to tie any animal up securely was not to be thought of, so out we all sallied again. This time, after much struggling, each seal was lashed up like a hammock with frequent turns of rope round the body from the nose to the tail, and finally they were once more secured to the cable.' In spite of all our efforts, however, in the morning we found that one of these animals had slipped through everything and disappeared.

'*April* 7.—To-day we found the sea open northward of a line from Hut Point, evidently the result of the late gale. The temperature to-day has risen to +10°, and, possibly in consequence, to-night furious squalls come from the E.S.E. towards the open water. I think our bay-ice is safe enough, but one can never tell. If it breaks now, we shall be in a very uncomfortable position, as both our boilers are run out and the engines are in pieces. A party with two large sledges and the dogs brought back eleven seals to-day, and will bring in some more to-morrow, so that we are now getting pretty secure for our winter stock.

'The work of getting comfortably settled is progressing. The winter awning is spread; it did not fit at all well, and we were obliged to make several alterations. It is

made of a thick, rough, flaxen material, called, I think, "waggon cloth," which I was at great pains to get, on advice. I believe we should have done better to have had it made of ordinary stout canvas. The winter awning ends at the mainmast, but we propose to construct a further covered way aft to the engine-room with our summer awnings and odd pieces of canvas. There will probably be a good deal of work in the engine-room during the winter, and it is well to have complete shelter to and from it. With the awning spread over the living spaces, we are obliged to use artificial light all day; but we should get little enough natural light even if the awning were not there.

'The men are building a snow-bank for our gangway, and another at the ice-foot to make a road to the hut; but the difficulty at present is to get snow. None has fallen recently, and that on the land is hard and icy. As our awning would not spread well over the boats, we have got them out, and hauled them over towards the ice-foot. They are now ranged in a line close to it, and there, it is to be hoped, they will remain safely during the winter.'

This latter step with regard to the boats was a fatal error, and afterwards gave us a vast amount of labour and trouble. It was yet another case in which we had to buy our experience sadly. Our principal anxiety had been to find a place where they would not be exposed to the full force of the winter gales, and we never thought of the danger which actually overtook them. It was not until the middle of the winter that we realised that what had been the surface of the ice was, under the weight of newly fallen snow, gradually sinking below the water-level, carrying the boats with it; and then, as it was impossible to commence rescuing operations till the daylight returned, we were forced helplessly to watch them getting into a worse and worse plight.

On the night of the 8th there was a great Emperor penguin hunt. 'It was blowing half a gale of wind, and the snow was driving rapidly past when someone espied a company of dignified "Emperors" advancing towards the ship. Our zoologist pointed out that here was the chance to complete our collection of skins, as the birds would now be in their finest plumage; and in spite of the weather a large party had soon surrounded the unfortunate birds. I was not present myself, but I hear there was much excitement. It is no easy matter to hold an Emperor; they are extraordinarily strong both in their legs and flippers, and are capable of moving even with a man on top of them. They could of course have been clubbed, but this would have damaged them as specimens. The proper method was to get hold of them firmly and give the *coup de grace* in a scientific manner by inserting the blade of a penknife at the base of the skull. The confusion in the dark, when everyone was trying to capture a bird and these powerful creatures were dashing in every direction, can better be imagined than described. Report says that frequently one man was trying to capture another under the impression that he was a penguin, and more than one of the party seem to have been temporarily floored by the wild dashes of the intended victims. It was late at night before sufficient specimens had been slain, and then the party returned with a plentiful supply of frost-bites, of which they had been quite oblivious in the excitement of the chase.' The above scene may sound somewhat bloodthirsty, but it is just to remark that we never slew animals except for the practical object of obtaining food or specimens or both; and, indeed, the more we came to see the extraordinary, unsuspicious tameness of the animal life about us, the more compunction we were forced to feel at the necessity of killing at all. It was difficult to realise at first the full extent of this tameness

—one is so little accustomed to total ignorance of man as an enemy—yet the attitude of both seals and penguins towards life is a very simple one. In the sea they prey and are preyed upon, and are adapted to such a condition; in that element they are swift, agile, and doubtless suspicious. But on the ice or on land they have never known an enemy—from all time it has been sanctuary, where they can mate, sleep, and rest without fear; and so the presence of an utterly unknown danger produces at first only consuming curiosity, and even when a vague feeling of alarm steals on their dull senses, they instinctively recoil from seeking safety in the sea, where alone safety is. It is interesting to think how different are the corresponding conditions in the far North, where for countless years the bear and the Esquimaux have ranged the floes, and the seal has become so timid that it is often difficult for the traveller to get within rifle-shot.

We found later on that the care which was taken on this night to shepherd the flock of penguins together before the victims were slain was quite unnecessary. So unsuspecting are these birds that they will stand stupidly by, without thought of flight, whilst individuals are cut out one by one from the group and killed. Even the last surviving member of such a group seems to remain unalarmed.

'*April* 9.—We found that the Emperor penguins killed last night are in splendid plumage. Many of them weighed over 80 lbs., and the largest turned the scale at 90 lbs.—quite a record weight. Rather a touching scene occurred when four or five stragglers from last night came boldly up to their dead companions, evidently at a loss to understand what it all meant.

'The sea is again open up to Hut Point, and possibly the inrush of cold air to the open water causes the extraordinary difference of weather conditions which

exist in different localities within our view. Some of the hills are clear and bright with sunshine, whilst others are dark with hovering clouds; at certain places it is undoubtedly calm, but at others the drift snow can be seen rising in clouds and sweeping furiously along. Towards Cape Bird there are heavy, low cumulus clouds with black under-shadows; there must be a great deal of open water in this direction. The various sky effects are very beautiful.

'*April* 13.—The ice has broken away enough to show open water around Hut Point ahead of the ship; it has been snowing all day, the snow falling in large, soft flakes, with a temperature of +17°. This afternoon we had several strong gusts from the south, and later the wind became more constant from the same direction and gradually increased to a full gale, when it shifted slowly to the S.E. with a rapidly falling temperature. Unfortunately, the windmill was left running after dinner, when it should have been feathered to the wind. The result is that some of the fans are badly twisted. I am rapidly losing faith in this unfortunate device, but I don't think that it had a fair chance to-day, and I shall suggest to the engine-room staff that it ought to be repaired if it is not too far gone.' For days after this the windmill was under repair, all the bent fans were taken down and carefully straightened below, but the task of replacing them was anything but pleasant, and hour after hour our excellent engine-room people spent aloft in the bitter wind, seated on cold metal, clinging to cold metal, and often obliged to handle their cold metal tools with bared fingers. Nothing would persuade them to give up, however, until the work was completed and the windmill once more revolving merrily.

'*April* 17.—All our former ski runs are now impossible; most of the snow-slopes are covered with hard high *sastrugi* raised by the late winds. Everywhere the snow

is packed by the same cause, and the surface is so hard that it is impossible to climb the steeper inclines even in boots. Some of the men are out occasionally with a football, but the wind interferes sadly with all forms of sport, and in anything like calm weather most of us prefer to take walks to spy out the land. There are such a number of old volcanic craters close about us that it will be long before we become thoroughly acquainted with all the folds and valleys between, and for many a month yet we may hope to find new features in our neighbourhood and some fresh interest in our daily exercise.

'The sun does not now rise sufficiently high to shine on the ship, but about noon one can see it from the eminence of Hut Point. . . .'

'*April* 20.—A bright day with moderate northerly wind. The young ice just formed over the open strait crowded down on the old and rode over it in many places. The sun is very near its departure; to-day it appeared a highly refracted elliptical ball of red, giving little light and no appreciable heat. For a few minutes it bathed the top of Observation Hill in soft pink light, then vanished beneath a blood-red horizon.'

This was the last we saw of the sun till it returned to us more than four months later. Its actual date of disappearance was the 23rd, but after the 20th we had a return to what, at this time, appeared the normal weather conditions, and for the three following days my daily journal opens with the same remark: 'Wind still blowing hard with an overcast sky.' It was not a very enlivening prelude to the coming darkness, but it would have taken far more than this to depress us in our novel surroundings, and all felt the propriety of the celebrations on the night of the 23rd, when hilarity reigned supreme, and with a liberal allowance of extra grog we drank to a speedy passage of the long night.

The winter was now upon us. The ice about the ship had been firmly fixed for nearly a month, and there seemed little reason to suppose that the heaviest gale could move it before the following summer. For good or ill we were now a fixture, destined to spend our winter nearly 500 miles beyond the point at which any other human beings had wintered, and therefore about to face conditions at which we could only guess.

Before us lay a weary spell of darkness, but we came to it in full health and vigour, and all that skill could devise to provide for our comfort and lighten its monotony seemed within our grasp. Each day would bring us nearer to the longed-for spring, and to the day when, with high hopes, we should step forth on those new trails which met at our door and vanished in the unknown.

CHAPTER VIII

THE POLAR WINTER

Winter Routine—Obtaining Water—Meals and Meal-hours—Pastimes—Officers' Routine—Debates—Exercise—Work of the Officers—Weather Conditions—Heavy Blizzard and its Effects—Incidents of the Winter—Winter Clothing—Remarks on our Food—Sunday Routine—Discomforts of the Living-quarters from Ice—Heating and Ventilation—Mid-winter Day.

> The cold ice slept below,
> Above the cold sky shone,
> And all around
> With a chilling sound
> From caves of ice and fields of snow
> The breath of night like death did flow
> Beneath the sinking moon.—SHELLEY.

LONG before the sun left us we had settled down into a regular routine of daily life, and although when it was above the horizon the hours of work were modified and generally increased, our meal-hours remained unaltered during the two years which saw us in the grip of the ice.

The following description of our daily life on board is contained in my diary of the early months of our first winter:

'The first task of the day is to fetch the ice for the daily consumption of water for cooking, drinking, and washing. In the latter respect we begin to realise that

many circumstances are against habits of excessive cleanliness, but although we use water very sparingly, an astonishing amount of washing is done with it, and at present the fashion is for all to have a bath once a week. To fetch the ice in the morning a party of men are roused out somewhat earlier than their comrades, and dressing themselves according to the weather, they proceed to the ice-quarry with a heavy sledge specially fitted for the work. The harder and bluer the ice, the better it is adapted for melting and the less fuel is required to melt it; had we been obliged to use snow, either hard or soft, the daily task would have been much heavier; but by good fortune we have a very solid icy slope on the land not more than 200 yards from the ship, and here we have made our quarry.' For two years we dug in an area no greater than twenty yards across, and yet at the end of that time, when we must have removed many tons of ice, we scarcely seemed to have scratched the surface of the slope: such are the puny efforts of man!

'A quarter of an hour of hard delving with pick and shovel each morning is sufficient to supply our daily needs; the sledge, loaded with ice-blocks, is towed back to the ship, and the blocks are then carried on board and placed in a convenient storage close to the main hatchway. The pile thus made is kept well in advance of our needs in preparation for spells of bad weather when digging may be impossible. Long before the departure of the ice-diggers the cook's mate has been astir with the galley fire alight and the coppers and ice-melters filled so that by 8.30 the men's breakfast is prepared. By this time all hammocks except those of the night watchmen are lashed up and stowed away, and the linoleum-covered mess-deck has been washed and cleared up. Breakfast is a very simple meal, and consists always of a large bowl of porridge with bread and butter and marmalade

or jam. For a long time a hash or stew was prepared, but as appetites fell off with our comparatively confined life this was rarely touched, and is now practically discontinued; on the two mornings of the week when seal's liver replaces the more ordinary meat, however, there is no such abstinence; everyone partakes of this excellent dish and wishes heartily that the seal was possessed of more than one liver.'

I may here mention that when we came to slaughter seals for our second winter there was a strong temptation to kill them for their livers only, and I think it is a creditable fact that we refrained from obtaining this luxury at a rate so expensive to life, but confined ourselves to the due proportions which fell to our share in treating the whole animal as food.

It is extraordinary how our liking for porridge grew upon us; we none of us cared much for it at first; naval sailors rarely do, and I believe it has lately been struck off the list of food supplied to the naval service; but with us the taste for this excellent food grew ever stronger both with officers and men, until we not only made our breakfast exclusively from it, but decided to include the more easily cooked variety in our sledge rations.

'After breakfast the mess-deck is again cleared up in preparation for prayers at 9.15, after which the men are assembled and told off for the work of the day, which is arranged as far as possible so that each man gets his fair share of the outside tasks.' I do not remember a time when there was not a great amount of work to be done. During the latter part of the first winter, and throughout the whole of the second, a large party were constantly employed on our sledging outfit, making or repairing sleeping-bags, sledges, tents, cookers or other details of equipment. Out of doors there was generally some work in the digging line, either piling snow around the ship or the huts, or digging out various objects which had become

buried, or making holes in the sea-ice for fish traps, or freeing the entrances and the paths to and from the huts, or many other lighter tasks. Then, again, the awning, the chimneys of the stove, and many outdoor instruments needed attention and repair, and few of our heavy winter gales passed without creating some havoc which had to be rectified.

'Dinner for the men is at one. This varies with the day, but consists always of soup, seal or tinned meat, and either a jam or a fruit tart. After dinner the rum is served out in accordance with naval custom. I am not at all sure the men would not be better without it, but perhaps some would feel aggrieved if it was stopped, and the small daily allowance can do little harm; of course it will be stopped when the sledging comes on. Smoking has been allowed on the mess-deck and at all times since we entered winter quarters; there are few non-smokers, and no one who dislikes the smell of tobacco. After two in the afternoon the men return to work until five; up to the present there has been enough to keep them going, but if, as is probable, it falls off, I propose to leave their afternoon free; there is no object in making work. Supper is at five; a few with good appetites make up dishes out of what remains of the tinned meats or seal left over from dinner, but many confine themselves to bread and butter and tea, with perhaps some jam or cheese. Those men who have not been employed outside during the day take their exercise after supper; there is no constraint, but luckily the men are intelligent enough to appreciate the advantage of good health and the benefit of a daily walk. There has been a difficulty in this respect with regard to the cooks and stewards, whose duties lie naturally inside the ship; with a little thought, however, we have been able to arrange a routine by which each has some spare time daily to devote to a walk abroad. In the evening all the men are free, and a

glimpse at the mess-deck at such a time leaves the impression that the greatest comfort and contentment reigns throughout. Many have some special work in hand, such as wood-carving, netting, mat-making, &c., which serves to fill in the spare hours; others play games or read; whist, draughts, and even chess are popular, and much time is beguiled by a peculiar but simple game called "shove-ha'penny." This pastime needs only a long board, with numbers marked in squares at one end and a halfpenny, which is placed on the edge at the other; the coin is jerked along the smooth board towards the numbers by striking the palm of the hand against the edge of the board, and the player of course scores the number at which the coin stops; whence this game came I know not, but I think it must bear a strong resemblance to the older pastime called "shovel-board." At any rate at present it affords much amusement and produces shouts of laughter; tournaments are constantly held in this, as well as in draughts and whist. At ten o'clock hammocks are slung, and soon all are in bed and asleep; only one or two sleep in the daytime, and perhaps in consequence all sleep well at night. There is no doubt that hammocks are far preferable to the bunks at one time suggested for the men; the large clear space which is left when the hammocks are stowed for the day is alone sufficient to prove this, but it is also certain that a hammock is drier and more snug than a bunk would be under our present conditions of life.'

Later in the year, on July 18, I note: 'During the darkest days, when work was slack, nothing was done by the men after their dinner, and I do not think anything is gained by making work; now that preparation for sledging has commenced, however, there is plenty to be done, and perhaps it is better to have such employment. Entertainments have been few and far between, but have counted for something, and Hodgson, Ferrar, and others

have given little scientific expositions on their special subjects which have proved very popular. It was a very usual thing in the old Northern expeditions to hold classes for school amongst the men, but in those days many could not read or write; with these accomplishments men are able to amuse themselves, as we have proved, and the officers have had the more time for their own in consequence. I have endeavoured to suit everything to the requirement of the moment, and was prepared if monotony and dulness crept in to attempt to dispel them, but there has been no necessity; laughter and good cheer accompany warmth and comfort in the crew space as well as aft in the wardroom, and all in all a brighter or more contented company than ours it would be difficult to conceive.'

'Reading on the mess-deck is of a very desultory character; Arctic books of travel are of course much sought after, simple and popular histories are frequently read; especially in request are such books as "Fights for the Flag," "Deeds that Won the Empire," and stories of the sea are much appreciated also. Novels are not very popular, though Dickens and Marryat find readers; old magazines seem to go the round many times and become much thumbed. Books of a quite different character from the above are often asked for, however; last week one man was deeply immersed in the "Origin of Species," another is studying navigation, and not a few have the evident intention of improving themselves. There is a good deal of writing as well as reading on the mess-deck, and the excellent articles that have been contributed to the "South Polar Times," show that much that is written would be well worth perusal. A goodly number of diaries are kept, some as personal records, but others for transmission home to the most-thought-of individual. It is difficult to say for certain, but as one looks on the cheerful, contented scene on the mess-deck

at night, one rather gathers the impression that the regular organisation of lectures and entertainments would disturb rather than add to the comfort of the community. Perhaps, however, a second winter would necessitate more effort on the part of the officers to amuse the men; without doubt the novelty of the first season counts for much.'

The contentment of the men was no transient condition dependent on novelty such as at this time I surmised that it might be. We afterwards settled down to our second winter with even greater cheerfulness, and, far from finding such a life monotonous and dreary, the men with the officers adapted themselves with ease to its placid course.

'The officers' routine is somewhat different from that of the men. Breakfast aft starts at nine and is concluded at ten; few are exactly punctual, but all have finished by the latter hour. The breakfast meal itself is precisely the same as that served to the men, as are all our other meals. I made this rule at the start of the expedition, and it has been observed ever since and will be observed throughout; without subverting discipline, it silences complaint. Two or three months ago, for instance, one of the few troublesome men in the ship, a merchant seaman, asked to see me to complain of some cake. When I appeared on deck he held a slice of cake in his hand and plaintively informed me that it was not fit for human food. I immediately sent down for a slice from a cake in the wardroom which we had been eating with pleasure, and of course found that the slices were precisely similar. As a consequence I could express my opinion of the complaint and its maker with the utmost freedom, and proceeded to do so. That officers and men should mess apart, and that the officers should have the privacy of their cabins for their work, &c., is all very right and proper, and marks a distinction which is in the best interests

of discipline; but in other respects it is an advantage on such an expedition as ours that all should share the same hardships, and, as far as possible, live the same lives. My rule does not of course apply to luxuries sent by officers' friends, to wines, or to a few delicate but indigestible trifles by which we increase the ward-room fare on the rare occasions when we have a special dinner; it is only a rule for ordinary circumstances, and one which will receive great extensions when we come to the hard sledging work that is before us, for then officers and men must live and work alike in every respect.

'From ten to two the officers have a good round interval for the routine work of the day; at two we have tea, the actual beverage being accompanied with jam, cakes, and toast. The latter is made at our own fire; the bread is cut off in huge chunks, and numerous patent toasting forks are brought into action. The toast made, it is spread thickly with butter until it is a sopping, dripping mass, suitable to nothing but a robust appetite; then the meal and the arguments begin, the latter being pursued to such lengths that the clock usually shows three before we break up. On the whole I think we all find this the most enjoyable meal of the day. In the afternoon those who have not been out already, start on their daily exercise; the rest melt away to their various tasks, self-imposed or otherwise, and it is not until 6 P.M. that we all meet again for dinner.

'This is the biggest and most formal meal of the day; each officer takes it in turn to be president for a week at a time, and during his term of office sits at the head of the table. Although we do not dress, we come as near to it as we can with a general tidy-up of costume; all are supposed to be seated before grace is said, and those who are not must duly apologise to the president for their absence.

'The dinner which follows is the same as that which is

served to the men earlier in the day, though with us it is served in courses on a comparatively clean, if not a white, table-cloth. Few of us drink any alcohol, except possibly an occasional glass of wine after dinner, or a small bottle of beer on Sunday with our mutton. We have a supply of "sparklets" that make excellent ginger-beer or lemonade, and some cider, which is sometimes drunk; but the total consumption of alcoholic drink is ridiculously small, and that not from any rule of living or example, but simply because no one seems to have any appetite for it. The consequence is we have a great deal of whisky and wine on board which will certainly never be touched.

'After dinner the table is cleared, grace said, the wine passed round, and the King's health formally drunk, when the functions of the president cease. Whilst the latter is in office the proprieties have to be observed on pain of a fine. No one is allowed to contradict the president, no bets can be made, and no reference-books can be consulted; these limitations, with a few others which are more rarely transgressed, cause a good deal of amusement. Arguments are started on every imaginable subject under the sun, and the flattest contradictions are given and returned; as the president joins in the conversation, the chances are that in the heat of debate someone will directly traverse his statements or back his own opinion by saying, "I bet you so and so"; in either case his eager messmates call immediate attention to his breach of etiquette, and he is promptly fined "wine all round"; no appeal is possible, and complaint is met by an increase of the penalty. "Wine all round" doesn't mean much in our abstemious community, but sometimes even those who are practically teetotalers will relax to drink the health of a hardened offender. After "The King" has been drunk there is generally a rush for reference-books, and then a good deal of

twisting of position to suit the reference. Our reference-books are fairly numerous, but (though we feel the lack of the "Encyclopædia Britannica") the "Century Dictionary," the Atlas, Haydn's "Dictionary of Dates," "Whitaker's Almanack," "Hazell's Annual," the "Statesman's Year Book," and some others, provide an ample field for supporting one's own opinion, refuting one's opponent, or at least for confusing the issue. I am not sure we get much "forrader" by our heated discussions, but it is a great deal better than being dull and silent; we have never yet sat through a meal without continual conversation, and I hope we never may.

'Dinner is followed by an hour or two of recreation, discussion, or work, a go-as-you-please arrangement; some finish off their daily work, some write, some read, and some play games. For some time now a game of "bridge" has been the evening amusement; five or six play, "cutting in" in the usual manner. No doubt the popularity of "bridge" will wane as has that of other games; chess was played for a long while, and will probably come to the front again. Most of us straggle off to bed between eleven and twelve, but some, myself amongst others, often stay up later. A few find that sleep does not come at all uniformly, but for my own part I sleep like a top.

'Every Tuesday after dinner we have a debate in the wardroom. I think Bernacchi first suggested this, and it was decided to have a technical subject one week and a lay one the next. The proceedings have always been very orderly, and throughout the winter nearly everyone has attended, though now their popularity is waning. On technical evenings we have discussed the barrier, the climatic conditions, the prospects of getting east and west, the seals, and the penguins, with results that have been both instructive and amusing. There is so much in these subjects that remains unexplained and

mysterious that everyone must gain fresh ideas from their free discussion; of the barrier we still seem to know all too little, but that little is contrary to preconceived notions, and the ideas it suggests are confused enough to need sorting, if we are to continue our exploration systematically in the spring. In the climatic conditions we have yet to explain the astonishing differences of temperature in different localities and with different winds, and to discuss methods by which we can get some notion of the snowfall and evaporation in our region; while with regard to seals and penguins, we feel there is yet much to be learned as to their winter habits, their breeding, and their migrations. In fact, our discussions, whilst helping to elucidate minor points in the problems in debate, have served to set those problems more clearly before us, and to indicate the manner in which we may hope to arrive at their solution. People are so very genuinely interested in all this that I think the lapse of enthusiasm in the debates arises merely from the knowledge that we can only hope to throw more light on the subjects by further exploration and observation.

'The non-technical nights are of course devoted entirely to amusement, and the subjects selected accordingly are such as to encourage the most startling statements and lines of argument; thus we have had "The Trade of the Empire," "Conscription," &c., subjects on which, without knowing anything, everyone can talk. Needless to say, such debates generally end in more or less of an uproar.

'The day's routine for the officers gives four clear hours before tea and three after; during these hours all without exception are busily employed except for the hour or more devoted to exercise; the best time for this is now about noon, but during the very dark days the moon was a potent influence in fixing the time.

In this, as in other matters, I have endeavoured to avoid all irksome rules and regulations. The officers are only too eager to go out for a breath of fresh air; the men have outside employment in fetching ice, tending their dogs, taking observations, &c., and in fine weather need no spur to be out and about with a football or on ski; the only class for which it has been necessary to make special arrangements are the cooks and domestics, whose duties are apt to tie them to the ship.

'My own time is taken up in organising the spring sledging, drafting instructions, calculating weights, searching up references, &c.; it would be difficult for an outsider to understand what a mass of detail this lands one in. I try also to keep touch with the work which is going on in the various departments, and am endeavouring to do some physical work in connection with the ice and snow which would otherwise be neglected; but such matters are attended with great difficulty to an untrained observer, and it is only when one comes to make the attempt that one finds that a simple experiment is almost an impossibility; every condition is complicated by outside variable causes.'

To give an instance of what was evidently meant by this paragraph I may mention that it was suggested in our 'Antarctic Manual of Instructions' that a block of ice should be suspended in the sea and its rate of increase in winter and decrease in summer should be measured. Had we attempted to do this, probably we should have arrived at an utterly false conclusion, because in no two places would the result be the same; in one place, for example, the block would most certainly have disappeared early in the summer, whereas in another it would have been diminished by little throughout that season. This difference was dependent on the movement of the sea-water, but it shows the

impossibility of carrying out experiments of this sort, however easily they may be conceived in the quiet of an English study.

'I find time also to read up Arctic literature, of which I am woefully ignorant; most unfortunately, our library is deficient in this respect, as owing to the hurry of our departure many important books were omitted. We have Greely, Payer, Nares, Markham, McClintock, McDougall, Scoresby, Nansen's "Greenland," and a few others of less importance; but, sad to relate, Nordenskjold, Nansen ("Farthest North"), and Peary are absent, and two of these at least would have been amongst our most valuable books of reference. Yesterday I was pleasantly astonished to find that Wilson had some notes on Nansen's "Farthest North," giving extracts of his sledge weights, &c., and these may be of great use in calculating our own weights.

'The work of the various officers is so distinct, and keeps them so busily employed, that we rarely meet except at meal-hours and in the evenings. Armitage is reworking the observations for position taken during the summer cruise, and correcting his magnetic data. This is a very sedentary employment, but occasionally he is to be seen out on the floe with the large theodolite taking star observations for the rating of the chronometers—a very cold job, both for the observer and for the timekeeper, in which capacity I sometimes attend.

'It is satisfactory to find that all four chronometers are keeping a steady rate, notwithstanding that the temperature in the chronometer-box frequently falls below freezing-point. Every morning the clocks are set by the chronometer, so that our daily routine is timed to the minute.

'Luckily Koettlitz has not much to do in connection with his medical duties, as there is little sickness, but occasionally there are wounds and cuts to be dressed

and small ailments to be doctored. In his daily walk he has undertaken the important duty of reading the thermometer off Cape Armitage. It is an instrument with a minimum indicator, and is attached to a post about 1½ mile from the ship. As I have before remarked, even at this very short distance the common difference of temperature between it and the ship's screen is from 10° to 15°. There are regular duties in the medical line which are of great importance, and which are shared by the two doctors. Every tin of food has to be examined by them after it is opened and before it is served out. This is no light task when hours are considered; for instance, Wilson has to be out early to examine the milk for the day. Another self-imposed duty of the doctors is to take weights and measurements and examine the blood of everyone, fore and aft, once during the month; all the information thus obtained is tabulated by Koettlitz, forming a very interesting record of the changes in different individuals living more or less under similar conditions.

'Soon after the first of each month in the evening we all gather in the wardroom clad in pyjamas, and are put through our paces as follows: Our weight is taken, and then the measurement of chest, filled and empty, waist, calf, forearm and upper arm; then, by means of a small spring instrument, our power of grip with right and left hand is recorded, and finally the capacity of our lungs is measured as we discharge one long breath into the spirometer.

'This performance is an entertainment in itself, and bets are freely offered and taken on the results, especially by those who fondly hope for a smaller waist or a stronger grip.

'Generally on the following night the same scene is enacted on the mess-deck, with the same display of chaff and good-humour. One has but to cast one's eye over

the records that come from this quarter to realise what a splendid set of men we have from the point of view of physique. Some turn the scale at over 190 lbs., and several at over 180 lbs., without an ounce of superfluous fat; and though in some cases we can equal the blowing powers of these individuals, we cannot compete with their grips; in fact, a specially strong instrument is usually employed to prevent all chance of the ordinary one being wrecked.

'The further monthly examination of our physical condition consists in an examination of our blood. Our senior surgeon goes to each individual in turn with a special needle and a small test-tube; the former is plunged into the finger of the victim, and as the blood oozes out, it is drawn up and transferred to the test-tube. The first test is to dilute a given quantity with water and to compare the resultant colour with a standard; water is added until the colours are equalized in shade, and the richness of the blood is of course in proportion to the quantity of water added. The next test is carried out by putting a drop of blood on a graduated slide under the microscope and counting the numbers of red and white corpuscles which lie in one square millimetre. To obtain samples of blood from forty-five people and to examine them in this manner takes a considerable time, and Koettlitz is kept extremely busy for some days. So far we have always published the results of the examination as well as the weights and measurements, principally because they display no sign of any change in the general condition; there has been a falling-off in weight in a few cases, but others have put on more than the number of pounds lost; measurements and strength have shown merely slight fluctuations, but with few exceptions the blood has grown richer. I have no clear idea as to what the meaning of this may be, and I do not think that the

doctor has either, but we are inclined to look upon it as a hopeful sign of our well-being.

'But to return to the manner in which our officers pass their days. It would be difficult to say who is the most diligent, but perhaps the palm would be given to Wilson, who is always at work; every rough sketch made since we started is reproduced in an enlarged and detailed form, until we now possess a splendid pictorial representation of the whole coastline of Victoria Land. Wilson starts his day early by an examination of the breakfast food; his next business is to see to the ventilation of the living-spaces, which he does so thoroughly that when we come to breakfast there is no complaint about the freshness of the air, though occasionally people appear in fur mits as a mute protest against the temperature. He next takes the eight o'clock meteorological observations, and after the men are told off for the work of the day his business takes him to the superintendence of those who are detailed for bird-skinning and who carry on this work in the main hut. Under his direction a few of the men, and especially Cross, have become quite expert taxidermists, and the collection of prepared skins is gradually growing.

'The rest of his day is devoted to working up sketches and zoological notes, making those delightful drawings for the "South Polar Times," without which that publication would lose its excellence, and performing a hundred and one kindly offices for all on board. He and Shackleton generally journey together to the top of Crater Hill, a height of 950 feet, each day, and return with a record of the temperature at our second outlying station. It is curious that although this temperature is generally lower than that in the ship's screen, it is rarely as low as that off Cape Armitage, and the fact almost seems to point to an inverted temperature gradient over the great ice-plain.

'The day starts early with Royds, our first lieutenant, also, for he must be up to see the men started at their various jobs. His special care is the meteorology, and the manner in which he sticks to what might well be considered a monotonous task is beyond praise. Rough or fine, every two hours from 10 A.M. to 8 P.M. he journeys forth on his round of observations. Regularly each morning the fair record books are produced on the wardroom table, and the rough observations of the previous day neatly entered in their columns. With the care of the ship's work, the maintenance of the various instruments in good working order, and many a stray task, it can be imagined that he has few idle hours. But one at least he finds—that immediately before dinner, when he goes to the piano and plays it, sometimes with and sometimes without the aid of the pianola; in either case we others in our various cabins have the pleasure of listening to excellent music, and feel that the debt of gratitude we owe to our only musician is no light one. This hour of music has become an institution which none of us would willingly forego. I don't know what thoughts it brings to others, though I can readily guess; but of such things one does not care to write. I can well believe, however, that our music smooths over many a ruffle and brings us to dinner each night in that excellent humour, when all seem good-tempered, though "cleared for action" and ready for fresh argument.

'Shackleton is editor of our monthly journal, the "South Polar Times"; he is also printer, manager, typesetter, and office boy, and consequently a week before that publication appears he is kept pretty busy. At slacker seasons he conducts experiments to determine the salinity of the sea-ice and the sea-water about the ship, sees that the dogs are properly cared for, besides many other odd jobs, and at all seasons he is responsible

for the serving out of provisions and for the proper regulation of the cooking and general galley arrangements.

'Hodgson, our biologist, goes steadily on with his outdoor work, and I think this is the first instance of dredging being carried on throughout a polar winter. He is rather inclined to scorn assistance, and seems almost to prefer to do everything himself—the manual as well as the expert work connected with his task. Lately he has accepted the assistance of a single man, but it is currently reported that this individual is required to look on whilst Hodgson digs, and much digging and a great deal of preparation is necessary before the nets can be actually used, so that it is only occasionally that a frozen mass is borne into the wardroom, which, on being thawed out, discloses the queer creatures that crawl and swim on the floor of our polar sea. Hodgson tells me he had expected to be obliged to devote the winter to working out his summer catches, and that it was a pleasant surprise to find that he could continue his collecting work during the dark season. No doubt it is also an excellent thing for his health, and he certainly remains surprisingly fit.

'Bernacchi up to the present has found plenty of employment in the care of his magnetic instruments; in addition to taking and developing the records, he has spent much time in tending the heating lamps in the huts and in endeavouring to render them more efficient. By banking up the principal hut with snow he has been able to keep it at a more equable temperature, but he tells me that even yet it is by no means satisfactory, which I very much regret to hear, as we are making very great sacrifices of oil in order that his lamps should be kept going—sacrifices which would land us in an uncomfortable predicament were we obliged to remain a second winter. In Bernacchi's department are also

included electrometer, auroral, seismic, and gravity observations; the which leave him no time for other physical work. As far as I can see at present, this is the point at which we are most lacking; with such curious formations of land and sea ice around us, we should possess a physicist and chemist who could devote his time principally to the many curious phenomena which they present.

'Of the lovers of fresh air, Barne is pre-eminent; it seems to bore him much to be cooped up on board; at any rate, in nearly all weathers he is out and about. He generally leaves the ship early in the day with his own special sledge, on which are mounted a sounding machine and a box containing reversible sea thermometers. With these he vanishes into the darkness and rarely reappears much before dinner. It is a curious sort of picnic life, and one which I imagine would be appreciated by very few. With a few sticks of chocolate in his pocket he journeys away to some distant crack or seal-hole, and there with the assistance of a flickering lantern he spends long hours, often in the intensest cold, letting down a string of thermometers, laboriously winding them to the surface, and recording the temperatures shown at the various depths. Could a more uninviting task be imagined? Indeed, it is doubtful if it even possesses the advantage of being useful. He sounds in depths of 200 to 400 fathoms, and rarely gets differences of much more than a tenth of a degree in the various layers, as naturally all the water in the strait is close on the freezing-point or something under 29° F. There will be interest, however, if we can continue the series when the summer approaches.

'Unlike the other officers, our geologist, Ferrar, inhabits a cabin at the fore-end of the ship, and there also is situated his small laboratory, the only one that is habitable under present conditions. Between meals

Ferrar is rarely to be seen, for his tasks are numerous. Out on the hillsides and on the floes signs of him can be observed—here a line of sticks, and there a few stones so weirdly disposed that one might almost imagine they served some fetish or enchantment rather than the object of discovering the physical conditions of our surroundings. On board one may see a shaft of ice bending under a weight with a notice, "Do not touch. —H. T. Ferrar." Below one may find the officer himself, sorting a box of geological specimens or polishing a section on his lapidary's wheel, but always busy in some way or another. It is a curious fact that I rarely meet Ferrar in my walks, and yet cannot speak of any feature of the numerous hill-slopes and valleys about our winter quarters without finding out that he knows it well.

'Skelton, our invaluable engineer, is also our photographer in chief, and has had a great deal of work in sorting and arranging the large numbers of photographs taken by various members of the expedition; the prints which he has already managed to get together are extraordinarily interesting, and if we can get together good photographic results on our sledge journeys our collection should be quite unique. But photography is now the smallest part of Skelton's duties; every officer in every department has had need sooner or later to solicit his services. The amount of mechanical work that is needed to make good every defect in such an expedition as this is truly surprising, and the work varies from the roughest to the most delicate task; without mechanical skill we should have been hopelessly at sea, and it is not too much to say that the majority of our scientific observations would have been brought to a standstill. To give only a few instances of the jobs which have been done of late sufficiently illustrates this statement: a short while ago the clockwork of the

Dyne's recording anemometer refused to act, and it was found that the hair-spring was rusted through; the only spare escapements were of a different pattern, but by drilling new holes one was eventually fitted to the instrument, which has been going continually since, though not of course at precisely the same speed as it maintained before.

'Last week, again, Hodgson found that his implements were unsuited to digging the slushy ice in his fishing holes. The only possible remedy was to forge new ones on a fresh design, and of course this was done. Quite lately our engineering skill has been called on for an extraordinarily delicate task connected with the cover of the gravity apparatus. This cover is placed over the pendulums, and its metal flange is supposed to rest so truly on the base that it forms an air-tight joint when the space beneath the cover is exhausted; on trial of our instrument, however, it was found that the joint was not true, and there was considerable leakage. How the flange became strained is not known, but the delicacy of bringing it into perfect truth again can be easily imagined. Yet this has now been done, and the pendulums are being swung as they should be in a good vacuum, which would certainly not have been the case had we not possessed engineering skill competent to deal with the situation. These instances are only some of many; all day long repairs, great and small, pour in upon the engine-room department, and one cannot exaggerate the importance of possessing a staff which is capable of undertaking them.

'I have written much to-day concerning our daily life, but as I proceeded it occurred to me to think of the view which those at home would take of a party of their fellow men condemned to four months of darkness, and I have thought that they would probably imagine a life in which there was a maximum amount of sleep and little

more activity than was necessary for the preparation and consumption of food. How far otherwise is the reality can be gathered herein, and to explain this must be my excuse for carrying description to such detail. Also, at home many no doubt will remember the horrible depression of spirit that has sometimes been pictured as a pendant to the long polar night. We cannot even claim to be martyrs in this respect: our life seems in every way normal; with plenty of work the days pass placidly and cheerfully.'

Life throughout our polar winters ran so smoothly that there was little to record from day to day but the changes of weather and those trifling adventures and incidents which loom so large at the moment, but diminish in importance as they recede into the past. My diary presents a running record of such circumstances and events, with here and there some lengthy digression explanatory of the general conditions under which we lived. It is difficult to extract from these memoirs in connected fashion, and at the same time to observe a chronological sequence of events, without falling to some extent under the influence of the diary form, but in adopting this form I shall suppress as far as possible the repetition of entries which might weary the reader.

It can be readily understood, however, that what is usually conceded to be an easily exhausted conversational topic, the weather, was to us at this time a matter of extraordinary importance. In this respect it has rarely, if ever, been the lot of a polar expedition to be so unfortunately circumstanced as we were, and consequently we had much that was novel in our situation, even when the experiences of former expeditions are considered. Almost without exception the North Polar winter has been recorded as a period of quiescence, when, although the thermometer has fallen to low limits, the atmosphere has remained comparatively undisturbed; but with us calm

weather was the exception, and we eagerly looked to take full advantage of such breaks as occurred in the monotonous round of windy days.

'*April* 30.— . . . Wind still blowing from the old quarter, with temperature fallen to $-27°$.'

'*May* 2.— . . . A moderate breeze in the forenoon developed into a southerly gale during the afternoon, and in the evening it was blowing in furious squalls. Word was brought down that the windmill was straining badly, although it was feathered to the storm—a precaution which the engine-room staff have been careful to take in good time since the last breakdown; at about 8 P.M. it snapped off short, and now lies a wreck on the forecastle. So this is the last of our electric light, though for some time it has seemed hopeless to expect the system to work satisfactorily. It is some comfort to know that this last breakdown could not have been prevented; it reveals a radical weakness in the windmill itself, and entirely supports an opinion expressed to the expert who fitted it.

'Outside the snowdrift is so thick that one cannot see a yard in front of one's face; it is whirling and eddying about the ship in such a manner that were one to lose touch of a guide-rope he would be immediately lost. No one has been outside for more than a few minutes, except the observers, and to-night even they are not going beyond the ship. Five minutes in the open is sufficient to powder one from head to foot, and though the temperature is comparatively high, the snow crystals lash so sharply in one's face that it is necessary to protect it with a mit, and even thus there is imminent danger of frost-bites. The awning is swaying about in the most alarming manner—it seems a great question if it will last the night; the drift is almost as thick beneath it as outside. The tops of the chimney-funnels have come off and gone heaven knows where; the result is a down-draught in the chimneys which at first filled the living-spaces with choking

smoke until the fires were put out and skylights and doors opened. The latter have now been closed again, and as we sit in rather chilly comfort below we can hear the wind howling through the rigging and the awning flapping noisily in its wild efforts to escape.

'Notwithstanding her icy surroundings one can actually feel the ship give to the more furious squalls, and the tide gauge is moving up and down as much as five or six inches at irregular intervals; it looks as though the ice-crust of the strait is depressed as the heavier gusts sweep over it. In spite of the din without, the fireless condition within, and some anxiety as to what we shall find missing after the gale, we have had quite an interesting debate in the wardroom on "Women's Rights"; each man was allowed a period of twelve minutes in which to set forth his views, and managed to cram into it as much nonsense as he could think of in that space of time; even the married men felt that it was an occasion on which they could speak with the utmost freedom.'

The gale continued throughout the whole of the 3rd. In the short lulls we could see that the snow was drifting high about the ship; all our instruments had long been choked up; the temperature in the fireless living-spaces fell to 35°, outside the thermometer stood at – 5°, but we had some comfort on seeing the gradual accumulation of snow weigh down the awning into a more secure position.

'*May* 4.—The wind has gone to the S.E., and though there is still some drift, we have been able to get out and observe the results of the gale. The first discovery was that the strait was clear of ice within 150 yards of the ship, and here, almost in the middle of winter, we find open water little more than a couple of ships' lengths ahead of us. Not only has all the ten-days-old ice gone, but a considerable portion of that which was formed five weeks ago has broken away. I once thought of the possibility of wintering in Arrival Bay; that place is now quite free

of ice, and where we should now be had we adopted that plan is beyond the power of guessing. The snow lies in mountainous drifts around the ship; from a few hundred yards' distance she looks to be buried. On the starboard and lee side the drift slopes down from the gunwale itself, and on the port side it stands higher, but between it and the ship there is a deep trench almost free of snow; this is always the manner in which snow drifts about an object.

'The meteorological screen has drifted up to six feet, and somewhere far beneath the present surface lies the snow-gauge—a fact that makes comment on the utility of that instrument unnecessary. The Dyne's anemometers have been drifted up since the earlier hours of the storm, and thus fail to record the wind at exactly the time when such a record would have been most valuable. On such occasions even the Robertson anemometer seems unreliable, as the caps get partially filled with the clinging snow-crystals. The awning is heavily weighted with snow and sadly torn: the boats' crutches and other projections have made clean breaches in it. The windmill lies an ugly wreck on the forecastle, and the shaft and standards which still remain up look particularly forlorn. We cannot yet get at the chimneys to repair them, and though the fires have been restarted we get a plentiful supply of smoke in our quarters.

'The dogs, or rather their kennels, were dug out this morning and found none the worse; we have lately brought them from the shore and disposed them near the bows of the ship, and luckily none were placed where the worst drifting took place. It is evident, however, that the dogs do not like the idea of being drifted up; very few had used their kennels during the storm, preferring to coil themselves down outside, where they could break out when the weight of snow got too great.

'*May* 5.—We still have some wind from the eastward, but curiously the temperature has gone up to +5°, so

that it is positively enjoyable to walk about outside. The storm has buried the ice in the bay by about three feet on an average, though the snow is very much deeper about the ship and close to the ice-foot. It is strange that we had little or no warning of this gale from the barometer, though the pressure fell during the blow. Bernacchi found exceptionally high electrometer readings as much as twelve hours before the wind came on; one wonders whether this instrument can be relied on to give warning of a blow—it would seem not altogether improbable. The dogs have now got over their recent unclothed state and have grown very thick, shaggy coats.'

Except when we said farewell to our winter quarters, I do not think we ever had quite so heavy or so prolonged a gale as that which has just been described. The wind swung round also in a manner which gave all the indication of a revolving storm whose centre had narrowly missed us, and the gale was followed by a result which we did not experience again, or at least only to a much smaller extent. The temperature remained extraordinarily high for several days after the storm; on one occasion it rose to +17°, and it was not until the 9th that it fell again below zero, and then it fell rapidly. On other occasions the temperature rose regularly with a southerly wind, but fell when the wind dropped or changed direction. The whole subject of this astonishing and inexplicable wave of warm air is so interesting that it is well to remember that the conditions under which it occurred were not always precisely the same. With the warm air on this occasion came a comparatively high degree of evaporation; the drifts about the ship diminished rapidly as the snow settled down and packed, and we could observe for the first time some of the extraordinary conditions under which packed snow-crystals adhere.

'The snow has drifted and hardened against the side of the magnetic hut, forming a coating from three inches

thick at the bottom to about one and a half inch at the top. For some reason, possibly change of temperature, the inner surface has been severed from the side of the hut, and the sheet has gradually bent back until it described a complete semicircle. A similar sheet curled back from the ship's stern shows her name clearly impressed on its surface.'

Around the cape the gale had produced high under-cut snow waves or *sastrugi*, whose thin overhanging edges would reverberate with a deep note when struck with a ski pole. Again from the summit of each perpendicular ice-face there were now single, double, and even triple cornices hanging in graceful festoons, actually formed by the adhesion of the whirling snow particles, but appearing to be formed by the overflow of the white sheet on the slopes above. This ever-changing condition of the snow was to many of us a fascinating study; it was not only that it lent to our walks a delightful variety, but we realised that it had a highly practical bearing on our sledge travelling. From start to finish of our journeys we must haul our sledges over this fickle substance, and according as its surface was hard or soft, sticky or clean, waved or smooth, so must our progress be measured. Those who have only seen snow under the soft, flaky guise which it assumes in a temperate climate must find it difficult to appreciate its infinite variety and bewildering changes under more rigorous conditions, which even the sledge traveller, whilst he is forced to appreciate, finds it impossible wholly to explain.

'*May* 12.—Fine, calm day; quite pleasant to be out in the morning. In the afternoon the temperature fell to $-37°$; as it fell the calm stillness on deck was interrupted by the continuous crackling of the contracting rigging, a succession of sharp, clear reports like muffled rifle-shots. In such calm weather, too, there are similar but intermittent reports at the tide-crack; as the water rises or falls with the tide the ice at the edge appears to hang for several

minutes and then to break up or down suddenly, starting from one end of the bay and running quickly through to the other with the sound of a miniature cannonading. The western sky was very beautiful this afternoon when I went for my walk after tea; the hills in deep shadow were sharply outlined against a background of crimson, fading through saffron to pale green, which merged into the slaty blue of a greater altitude. As the light failed the stars shone forth wonderfully bright and clear. . . .'

'*May* 13.—For a wonder another fine day, temperature down to – 43°, the lowest we have had in winter quarters. It is not the low temperatures that annoy, but the wind and foul weather, and we should suffer few inconveniences if we had not the latter to face so constantly. A party of four of us went round to Seal Bay to examine the ice-ridges, where the temperature was evidently much lower though we had no thermometer. Beyond the necessity of occasionally warming our noses and cheeks, however, we were quite warm and comfortable. We passed a seal blow-hole at which the owner remained placidly breathing under a dome-shaped covering of snow, even when the dogs barked and scratched the snow down on his nose. There is not much light now, even at noon, and by two it is quite dark. Can one hope that the last few days of calmer weather are an earnest of better conditions to come?'

'*May* 16.—Wind blowing harder than yesterday—in fact, over forty miles an hour—with temperature down to – 35°. There is happily no sign of the ice breaking up again, but this is scarcely in keeping with the more settled conditions hoped for. Nobody is very anxious to be out: the wind cuts like a knife at this temperature. Poor Bernacchi had a very bad night, as it was his term-day, and he had to make several visits to the hut, and got frost-bitten in consequence.'

'*May* 17.— . . . Had an alarming evening. The wind

having lulled this afternoon, the boatswain and second engineer started off at 2.30 for a walk round Castle Rock, without giving warning of their intention except by a few casual remarks dropped in their mess. Later it came on to blow hard with heavy drift, but I was not informed of the absence of the men till eight o'clock, some hours after their messmates had begun to grow anxious. We immediately organised two search parties, and having made elaborate plans and fully dressed ourselves to face the elements, we stepped forth—to meet the absentees returning over the gangway. It appears they had an idea that our peninsula was an island, and started to walk round it. Not finding the other end, they got farther from the ship than they had intended, and then the drift coming on, they had to feel their way along the land to get back, and so reached the ship in a very exhausted and frost-bitten condition. There must be no more of this casual wandering about.'

'*May* 19.—Still the never-ceasing easterly wind; the barometer has risen very high, but, high or low, the wind persists, lulling and rising, and again lulling and rising, till one grows heartily sick of it.'

'*May* 21.— . . . Wind from the eastward, increasing during the day to a howling gale between five and nine. It is curious how clearly I can hear the wind in my bunk at night. Each gust is distinct as it shrieks through the rigging, and it is not inspiriting to lay awake and think to this weird and rather dismal accompaniment; one begins to wonder whether it ever will be calm again. On the other hand, as the sound is precisely that of a storm at sea, one cannot but take great comfort in reflecting how infinitely pleasanter it is to listen to it under such restful conditions rather than when tossed about on the mountainous seas of the Southern Oceans. Overhead to-day it is calm and bright, with peculiar luminous cirro-stratus cloud towards the south, but for some feet from the sur-

face the air is thick with driving snow. How used we are getting to the sound of this driving snow! I seem to have heard the same as the dust was swept along a hard, sandy road; it is almost like the patter of hail; to all intents and purposes our snow is fine sand.'

'*May* 22.—A day of hard wind, ending in a beautifully fine calm moonlight night. We all went out in the evening, and in the clear silvery light were able to see about us for the first time for many days. The scene was perfect in the pale white light and silence. Later there was a curious effect of frozen fog; the nimbus cloud seemed to descend on the hills and roll over us, leaving the ship free, but though all around us was clear, there was a heavy deposit of ice-crystals on masts and ropes which shone and sparkled in the moonlight. Now the ship looks spectral in her white shimmering robe, the mist-clouds are rolling down the hillsides into the snow-covered hollows, and a strong wind can be heard high above us, though all below is calm. The whole scene is so weird that it gives one a positively eerie feeling.'

The foregoing extracts show how persistently the wind annoyed us about this time, and, indeed, so matters continued, with occasional calms, when we could enjoy our outdoor strolls, and occasional gales from the south, when, though the temperature rose comparatively high, it was unsafe to venture far from the ship.

'*May* 31.—Temperature abnormally high (+8°). Went well out over the ice to the westward, where the recent snowfall has improved the surface for ski; found three seals up on the ice, the first that have ventured up for a long time. In the cold weather they never seem to quit the water; evidently they know when the thermometer rises. It is now pretty dark, even at noon, and dismal enough when the fine snow is driving past and the sky overcast. Regret to say one of the dogs, "Paddy," was found dead this morning. A *post-mortem* revealed a

deep wound in his side, and when "Nigger," acknowledged king of the pack, approached with the most innocent air and wagging tail, and it was found that he must have slipped his collar in the night, there was little difficulty in guessing the cause of the disaster and fixing the guilt. The curious thing is that "Paddy" appeared to be "Nigger's" sole and only friend; their kennels were adjacent, and as "Paddy" was always content to play second fiddle, there seemed no chance of a rupture. The deed must have been done in the silent hours of the night, and alas! we shall never know the cause. There is nothing to be done but to bore an extra hole in "Nigger's" collar. I trust we are not to lose more of our dog team: this is the second loss since the winter set in, as poor "David" died last Sunday from causes unknown.

'I do not think it would be possible to take more care of the dogs than we do. Each dog has his own particular master among the men, and each master seems to take a particular delight in seeing that his animal is well cared for. The most thoughtful are constantly out building extra shelters, covering the kennels with sacking, and generally endeavouring to make their charges comfortable.'

'*June* 2.—. . . As far as winter conditions are concerned, our clothing arrangements are satisfactory, and although the outlay in this direction was heavy, the excellent quality of our garments fully justifies it. Practically men and officers are clothed alike, such minor differences as exist serving only as a useful distinction of costume on board the ship, and not signifying any difference in the quality or comfort of the garments worn by either.

'Everyone wears the thick warm woollen drawers and vests supplied by the expedition, and over these a flannel or woollen shirt and pilot-cloth trousers. On board the ship the outer upper garment of the men is a dark woollen jersey, but that of the officers a brown "cardigan" jacket. Some of the more chilly individuals put on an

extra waistcoat, but few wear the thick jacket which is supplied with the pilot-cloth trousers, the jersey or cardigan giving excellent freedom to the limbs and movements. The men's jerseys come well up around the throat, and they need no additional neck protection; but the officers wear a variety of comforters or scarves, or sometimes a flannel collar. Dressing for dinner is a more or less punctilious performance, and generally means the donning of the Sunday cardigan and neck-scarf.

'For ship wear there are some warm, comfortable slippers provided for both officers and men, but many prefer to remain in their Russian felt boots. These were especially obtained from Russia at a very small cost, and are perhaps the most satisfactory foot-wear we possess for general purposes, now that we have modified them to suit our requirements. The modification consists in adding a *sennet* sole made from ordinary spun yarn and secured to canvas which is closely fitted and sewn to the boot; by this device the felt of the boot is protected from wear, and our people are able to do a great deal of work both inside and outside the ship in this comfortable foot-gear. The only drawback is that when it is snowing or drifting the fine powdery snow clings to the felt, and on being brought into the living-spaces melts and wets the boots. Even in fine weather this happens to the sole, and for the sake of the boot it is really wiser to change before going out of doors. For walking abroad or climbing over rocks these boots are not well adapted, though there are individuals who from perversity or laziness continue to wear them for the purpose; the majority, however, change their foot-gear when they leave the immediate neighbourhood of the ship.

'English leather boots were soon found to be far too chilling to wear on such excursions, though better adapted to climbing over the sharp, jagged rocks than anything we possess; but for a long time we clung to the Nor-

wegian leather ski boot, which is a looser and easier fit, and therefore allows a much freer circulation in the foot; in fact, ski boots are still worn, and in some cases have been fitted with a stouter sole by the cobbling abilities of that excellent man-of-all-trades, Lashly. But most of us have by this time taken to wearing fur boots on our walks abroad, and now that we can always dry them on our return they are the most warm and comfortable footgear imaginable; the only trouble is that they wear out rapidly, especially on the sharp, stony hillsides, and as we may need many pairs for our sledge journeys we cannot afford to be too lavish in serving them out during the winter.

'These fur boots are made of selected reindeer skin and sewn with gut; the sole is made from the covering of the forehead both on account of the thickness of the pelt in this part, and also to obtain the twist in the growth of the hair which gives the boot a better chance of gripping on a slippery surface; the upper part of the boot is made from neck-pieces and is soft and pliable. Already we see that our stock varies greatly in quality, and that for our sledge journeys we shall have to make a most careful selection; but by wearing them now we are gaining experience of what constitutes a good boot, which is not at all the sort of fact that can be discovered at the first glance. Some officers and men have already resoled their "finneskoes," as these fur boots are called, with sealskin, but it is doubtful if there is much wear in the latter, though it is thick and hard; however, it is interesting to try the purposes to which the natural productions of our desolate region can be put, and it is to be hoped that our sealskin will be available for something more useful than the leggings, tobacco pouches, and knife sheaths which have so far been made from it.'

I may add that we never found this sealskin of much use: it was far too weak and brittle. Though possibly

we were not very expert in preparing it, it may be added that similar skins landed in Dundee some years ago were found to be practically valueless for the purposes for which the skin of the Northern hair-seal is employed. I do not know the reason for this fact, but it is evident that it should go far to ensure a peaceful existence to the Southern seal.

'Everyone is provided with a complete suit of wind covering for outdoor wear, and a second suit is held in readiness for sledging. This is made of a thin waterproof gaberdine material supplied by Messrs. Burberry, and will doubtless be excellent for our sledging, but for constant winter wear it is not adequate, and already we have strong regrets that we do not also possess suits of a thicker, tougher material. A light canvas would be just the thing for this rough winter wear, though it might become too stiff and icy on a sledge journey. It would have been better also and cheaper had we brought the material only, instead of the made-up garments, for our wind clothing; both officers and men can ply a needle more or less handily, and although everyone conforms to the same general cut of trousers and blouse, each has his own ideas in matters of detail, concerning the collars and cuffs, &c. It is doubtful if the original making of garments would have taken much more time than the very numerous alterations that have been made to suit individual taste, and even if it had, there is now ample opportunity for such work.

'The necessity of continually facing a blighting wind is calling forth original genius and inventive talent in devising a headgear which shall protect one's necessarily exposed features. Our helmets are made of a thick fleecy material woven of camel's hair, which is satisfactory enough for winter wear, though many of us are not in favour of it for sledging. When buttoned across, this helmet comes low on the forehead and circles round

over the chin and close under the mouth, leaving only the cheeks and nose exposed; but in a cold wind it takes all one's time to keep even these members from being frost-bitten. At first talent was devoted to finding some practicable form of 'nose-nip,' a semi-attached piece which can be disposed to cover the nose and cheeks in windy weather, but in spite of all efforts the same difficulty always arises: one's breath is caught as it ascends and freezes on it, gradually accumulating until one's face is covered with a mass of ice. The same drawback is found to occur to a greater degree with any form of face-mask. A new departure is now being developed by which a sort of blinker is placed on each side of the helmet, and each blinker is capable of being pushed forward according to the direction of the wind.'

The development of this new idea finally put us in possession of a device which proved really admirable, and which I can confidently recommend to expeditions that may be called on to face equally windy conditions. A light peak about two or two and a quarter inches deep, constructed of gaberdine stiffened with canvas, was carried across the forehead and down on each side of the face well below the chin, and attached to the edge of the helmet aperture; in its ordinary position, it lay flat back against the helmet, but either side could be thrust forward separately, or both together. The beauty of this device was that with the wind on either side one had but to push forward the guard on that side to obtain shelter, whereas if the wind was ahead one pushed forward both sides and, securing the lower edges together, obtained a funnel-shaped protection which held the air immediately in front of the face in comparative rest. With a very strong wind and a low temperature, no possible device can prevent frequent frost-bites, but this one went a long way towards mitigating the evil, and it had also the advantage that by peering beneath

the guard of a companion, one could readily tell if the frost had attacked him.

'We find not only that furs are unnecessary for winter wear, but cannot imagine that they would be otherwise than positively objectionable. It is reported that some of the old Arctic expeditions wore furs; the mess-deck under such conditions cannot have been very attractive. We wear furs only on our feet and hands, the latter are also protected by excellent woollen half-mits, which extend from the knuckles nearly to the elbow; armed with these and with one's fists thrust into a lined fur mit, one's hands may be comfortable in any weather. We have also excellent felt and woollen mits, which the men use for outdoor work. Should the wind get through these, the best plan is to wet them, as the ice forms the best possible protection.

'I regret to say that the clothing issue displays the fact that the sailors are extremely careless of their clothes; they seem to have an idea that there is an unlimited stock of socks, mits and such like, and have an obvious contempt for the "stitch in time." Of course there are the few careful ones by whom the others can be judged. More than once I have had to speak seriously about the wasteful use of food, clothes, and various articles of our equipment, but I am bound to confess that my words have not had any great result; in fact, even the cutting off of supplies does not seem to have any lasting effect. One may well wonder whether, in any circumstances, it would be possible to alter their happy-go-lucky nature. On the other hand, such a nature has its obvious advantages. One knows with these men that their resource will always be equal to the occasion, and even if they run short of clothing, one has a feeling that they will manage somehow.'

'*June* 10.— . . . In considering the excellent manner in which we are getting through the long winter and

the good health enjoyed by all, the share which our material comforts have had in the result must not be forgotten. We have fresh well-baked bread continuously, seal-meat three times a week, pies and other dishes of tinned meat three times, and fresh mutton once. To this is added a good supply of butter, milk, cheese, jam, and bottled fruits, whilst cakes are constantly made for all. There is, of course, a certain amount of sameness in the diet, and preserved foods are more likely to become wearisome than fresh, and of course, also, appetites are tending to grow fastidious from the inactive life; but, taking it all in all, the food is quite good enough to tempt us to eat a sufficiency, whilst, as may perhaps be equally fortunate, it is not so attractive as to leave us with any desire to take more than that sufficiency. The main point is that we all seem to thrive well on it. Perhaps the articles we miss most are fresh vegetables; tinned vegetables are always a poor substitute, and with the exception of the potatoes ours are unfit for food. Our preserved potatoes are as good as such things can be, but the best preserved potatoes are dull and uninteresting. The greatest drawback to the galley productions, however, is the cook. We shipped him at the last moment in New Zealand, when our trained cook became too big for his boots, and the exchange was greatly for the worse; I am afraid he is a thorough knave, but what is even worse, he is dirty—an unforgivable crime in a cook. I think if the men were free to deal with him it would be "something slow with boiling oil"; but, alas! one cannot be rid of the most undesirable in this far-off land: one is forced to make the best of a bad job. Luckily, he is a comparatively isolated blemish. Luckily, also, our cook's mate is a good man and an excellent baker; it is he who provides us with our good bread and toothsome cakes.'

'*June* 12.— . . . We keep a very regular weekly routine; each day has its special food and its special tasks, and as far as possible we stick to what the sailor calls "man-of-war fashion." The week's work ends on Friday; Saturday is devoted to "clean ship," and though we don't polish bright work, we do our share of scrubbing. In the forenoon the living-spaces are thoroughly cleaned, lockers and other articles of furniture are moved, holes and corners are searched, and whilst the tub and scrubber hold sway, the deck becomes a "snipe marsh." At this time also the holds are cleared up, the bilges pumped out, the upper deck is "squared up," and a fresh layer of clean snow is sprinkled over that which has been soiled by the traffic of the week. On this follows a free afternoon for all hands, and after dinner in the ward-room the toast is the time-honoured one of "Sweet-hearts and Wives."

'On Sunday we don a different garment; it need not necessarily be a newer or cleaner one—the thing is for it to be different from that which has been worn during the week. By 9.30 the decks have been cleared up, the tables and shelves tidied, and the first lieutenant reports "All ready for rounds." Then follows a humble imitation of the usual man-of-war walk-round Sunday inspection, and in solemn procession we pass through the now empty mess-deck and on to the other inhabited parts of the ship. I am more than ever convinced that this routine is an excellent thing; not only has it the best effect on the general discipline and cleanliness of the ship, but it gives an opportunity of raising and discussing each new arrangement that is made for the better comfort of all on board.

'After the inspection of the ship comes that of the men, who are fallen in under the awning on deck. Though it is only possible to see them in the rays of the flickering lantern which the boatswain bears ahead of me, I see

enough to assure me of the general good health and cheerfulness of the company. Then come the only military orders of the week. The first lieutenant says, "Front rank, one pace forward—march." We pass between the ranks, and the men are dismissed.

'After this the mess-deck is prepared for church; harmonium, reading-desk, and chairs are all placed according to routine, and the bell is tolled. The service is read by me, the lessons by Koettlitz, and Royds plays the harmonium. As he plays it extremely well, the responses are chanted and the three hymns are so heartily sung that I have no doubt they could be heard far over the floe. Service over, all stand off for the day, and look forward to the feast of "mutton," which is also limited to Sunday; by using it thus sparingly the handsome gift of the New Zealand farmers should last us till the early spring. But it is little use to think of the sad day when it will fail; for the present I must confess that we always take an extra walk to make quite sure of our appetites on Sunday.'

'*June* 15.— . . . It would be idle to say that we live in complete comfort below; perhaps it is as well that there should be difficulties to overcome. We have several weak places as regards damp and cold; the mess-deck is the best part of the ship; except for a little damp on the side there is not much to complain of; but the wardroom in general, and the after cabins in particular, are not so happily situated. We can now see that our insulation scheme is very imperfect. The upper deck is lined with asbestos, and is satisfactory; but the ship's side is not lined, and wherever the bolts come through the region inside is covered with a hard, spiky mass of ice. This ice accumulates in time, especially in the region of the bunks, and lately several people have had literally to chip out their mattresses, which were solidly frozen to the ship's side. At the

after-end of my cabin there is an iron bulkhead; it is lined with asbestos, but I imagine the latter must have slipped down, as the whole bulkhead inside is a solid mass of ice. Another very stupid arrangement is the plan of the small cabin deck-lights; these are made in a single metal casting, with double glasses; of course the metal forms a free conductor between the outside and in, and the fitting is consequently a natural ice-trap.

'But the worst feature of the wardroom is the deck below it, which has no lining, and out of which the caulking has fallen into the bunker. Except for the linoleum on top there is little in this floor to protect us from the temperature of the bunker, and the latter, being in direct communication with the engine-room and thence with the open air, is always considerably below freezing-point. As a consequence of this we get very cold draughts in the wardroom, and a thermometer placed on the deck anywhere but near the stove falls to 32° or 34°. A week or two ago it was so bad that I was obliged to sit in my cabin with my feet in a box of hay, an efficient but inconvenient foot warmer.

'Before the gale in May, when we had no snow about us, the ship was getting very badly iced up inside, but after that gale we were able to improve matters, and now they are a good deal better. At the end of April the temperature in my cabin averaged about 40° during the daytime and 33° during the night, a condition under which one was not tempted to dawdle over the processes of dressing and undressing; now the temperature keeps up to nearly 50°, except near the floor, where it is much colder. The course of improvement was accompanied by much thawing, and for some time we had a general dripping, which was much worse than the ice and infinitely more ruinous to our effects, amongst which mildew is already making rapid strides. In this way, as in others, we have had to buy our experience,

and since May we have been fighting the evil by banking up snow without and by nailing up quantities of felt within.

'The most difficult place to fight is the galley-space, because here it is impossible to avoid the volumes of steam given off by the cooking; directly this steam strikes against the cold sides of the compartment it condenses, and during cooking-hours this space is very much like a shower bath. We have improved matters a little by trying to guide the steam up through the skylight, but the place is still very bad.

'Our stoves have also been a source of trouble to us, and are likely to continue to be so. They are of the slow-combustion type, designed to burn anthracite coal, and though it was claimed that they would be equally efficient with our steaming-coal, we find that to burn it at all we must greatly increase the draught, and consequently we do not achieve the economy of fuel we expected. Under the impression that we should require them whilst magnetic observations were being taken on board, they were made of phosphor bronze (a non-magnetic material), and we now find that this metal burns so easily that one stove is already practically destroyed, and the other is in a bad way; luckily we have spare ones which are made of iron. But the worst trouble in this connection is perhaps not so much the fault of the stove itself as of the chimney; we find that with certain directions of wind it is impossible to avoid a down-draught, and directly the wind turns to this quarter we have to draw fires with all speed and remain fireless till the weather becomes more favourable.

'But the stove arrangement has its good points as well as its bad: it is satisfactory to find that we can do well with a single stove in each compartment instead of the two that were originally fitted, and the flat stove itself, with its broad grate and transparent talc windows,

not only forms a very cheerful object, but affords an excellent toasting surface, and as we gather round it before our cheerful midday tea we are not inclined to quarrel with its shape.

'It is laid down by Parry, I think, that no artificial ventilation is necessary in a ship wintering in polar regions, as the difference in temperature without and within is sufficient to cause a speedy interchange of air through the cracks or on the opening of doors. Such a dictum would hold at a time when it was exceedingly difficult to make a ship tight, and no doubt it would hold also in the present condition of the "Discovery"; but if our decks had been thoroughly caulked some form of air inlet would have been necessary, and an ideal living-space for polar regions should certainly possess a ventilating system capable of regulation and an entire freedom from casual draughts. An efficient ventilating system, however, is a difficult thing to provide in a ship at the best of times, and under polar conditions there are many circumstances which tend to increase the difficulty.'

As ventilation must always be a subject of serious consideration to polar explorers, it may be of interest to describe the somewhat ingenious system which was fitted in the 'Discovery,' and to point out in what respects it failed.

The idea was that fresh air entering should pass into a chamber and there become warmed by a small stove before entering the compartment; the vitiated air was to be drawn up through the exhaust which surrounded the funnel of the ordinary heating-stove, the heat of the funnel being expected to cause an up-draught. Of course, in addition to the air passing out at the exhaust under this system, a large volume of air would have to enter to supply the combustion of the stoves, but as long as there was an up-draught through the exhaust

the heated vitiated air in the upper part of the compartment would be drawn off. When we found that we obtained sufficient heat from the ordinary stove alone, much of the theoretical benefit of this scheme vanished. With changes of wind we had often to contend with practical difficulties, and there were times when the system was the object of universal contumely.

The question of fresh air and ventilation was one which afforded us a constant field for argument, and even our medical officers were divided in opinion, one making a bold stand for equable warmth, whilst the other contended that at all costs the purity of the air we breathed should be assured. In consequence of this, the community was divided into two camps, for and against the opening of the skylights; and as the members of each camp were desirous of arranging matters to suit themselves, the skylights were constantly flying up and down until a compromise was effected. It was decided that the skylight and the door of the companion should be opened every morning at 7.30, and not closed until the air in the compartment was thoroughly renewed, and that after that hour it should only be opened by general consent, and should the temperature rise above 60°.

'*June* 23.—We kept our mid-winter festival to-day, as yesterday was Sunday, and the ship has been *en fête*. The mess-deck was gaily decorated with designs in coloured papers and festooned with chains and ropes of the same material, the tables were loaded with plum puddings, mince pies, and cakes, mostly of home manufacture, but none the less "Christmasy" in appearance. It seems that there has been quite a rivalry amongst the messes with respect to their adornment, and the results which have been achieved with little more than brightly coloured papers, a pair of scissors, and a paste pot are really quite astonishing. On each table stands

some grotesque figure or fanciful erection of ice, cunningly lighted up with candles from within and sending forth shafts of sparkling light.

'At 12.30, when all was ready, I went round in procession with the officers, exchanging greetings for the season and accumulating sweetmeats, cakes, and such dainties, offered by each mess as a tribute of good will, and incidentally an evidence that we possess no inconsiderable amount of confectionery talent. Next came the unpacking of a large box of presents provided by the kindly thought of Mrs. Royds, the mother of our first lieutenant, and the distribution of these and other Christmas gifts sent by friends in the Old Country to gladden our winter season. Everyone was remembered, and with all in high spirits the distribution occupied the time with jest and laughter, until we left the men to enjoy their Christmas fare with an extra tot of grog.

'At six we had our dinner in the wardroom, with the table decorated and the display of all our plate. Starting with turtle soup, we passed on to a generous helping of mutton, and from that to plum pudding, mince pies, and jellies, all washed down with an excellent dry champagne. With a largely assorted dessert of crystallised fruits, almonds and raisins, nuts, &c., came the port and liqueurs, which brought us into good form for the enthusiastic speeches that followed. With such a dinner we agreed that life in the Antarctic Regions was worth living, and those who didn't make speeches felt that they must sing; and starting with "For he's a jolly good fellow," twice repeated, the evening continued with a regular "sing-song," when everyone, regardless of talent, had to contribute something for the common entertainment. One could not help wondering what would have been the feelings of those sympathetic friends who imagined the polar night to be filled with

gruesome horror, had they been permitted a glimpse of this scene of revelry.

'In the early hours we went out to cool our heated brows. It was calm and clear, and the full moon, high in the heavens, flooded the snow with its white, pure light; overhead a myriad stars irradiated the heavens, whilst the pale shafts of the *aurora australis* grew and waned in the southern sky. It was sacrilege to disturb a scene of such placid beauty, but for man it was a night of frolic, and as the dogs quickly caught the infection, the silence was soon broken by a chorus of shouts and barking which was continued long after the bare ears and fingers should have warned their possessors that the temperature was nearly into the minus thirties. Eventually even exuberance of spirit was forced to give way to rapidly growing frost-bites, and we retired within to contemplate, rather sadly, our extremities swelling as they thawed. Clearly under no conditions can one play tricks with our climate.

'We are half-way through our long winter. The sun is circling at its lowest; each day will bring it nearer our horizon. The night is at its blackest; each day will lengthen the pale noon twilight. Until now the black shadow has been descending on us; after this, day by day, it will rise until the great orb looms above our northern horizon to guide our footsteps over the great trackless wastes of snow. If the light-hearted scenes of to-day can end the first period of our captivity, what room for doubt is there that we shall triumphantly weather the whole term with the same general happiness and contentment?'

CHAPTER IX

WINTER PASSING AWAY

Our Settlement in Winter—The Large Hut—Lighting Arrangements on Board—Prevention of Fire—A Night on Duty—Smoking Habits—The 'South Polar Times'—Aurora Australis—Mishap to our Boats—Moonlight Effects—Lost in a Blizzard—Theatrical Entertainments—Nigger Minstrels—Increase of Light—New Arrivals—Concerning the Dogs—Return of the Sun—View from our Hills—Walks in Daylight—Preparations for Sledging—Ready to Start.

> Here Winter holds his unrejoicing court,
> And through his airy hall, the loud misrule
> Of driving tempests is for ever heard.—THOMSON.

> Morn
> Dawns on this mournful scene, the sulphurous smoke
> Before the icy wind slow rolls away,
> And the bright beams of frosty morning dance
> Along the spangling snow.—SHELLEY.

'*JULY* 18.— . . . The moon has greatly favoured us this winter by achieving its full dimensions during its monthly stay above our horizon; or, in other words, the full moon has approximated with its most southerly declination. The clear outline of the hills, the cold blue of the sky, crowded with brilliant stars, and the luminous sparkle of the snow make our moonlit days more beautiful than can be easily imagined. I have just returned from a walk around the settlement, when the moon to the south was yellowed by the mysterious noon

twilight and the northern sky was a flame of crimson. One dresses with care even on these calm days, knowing that the thermometer stands low and that there will be a keen bite in the lightest flickering puffs of air. Well protected, therefore, one closes the wardroom door on the bright yellow light and comfortable warmth within, and climbs the steep ladder to the entrance porch. These porches, with their double doors and insulated sides, are eminently satisfactory, and although they are thickly crusted with ice inside, and have occasionally to be chipped out, they save us from the keenest draughts and give space in which the snow of the outer world can be shaken off by those who enter. On arriving on deck one treads carefully over its soft snow covering, for here, beneath the winter awning, the gloom is deep, obstacles are numerous, and although fur boots may be an excellent protection against the cold, they are but a poor one against the sharp corner of a hatchway or the business end of a pick-axe; and indeed one is lucky if one reaches the flap-door of the awning without coming into violent collision with some obstacle, and feeling tempted to use equally violent language concerning the person or persons unknown who have unwittingly prepared the trap. From the ship's starboard or inshore side a gangway of stout poles and planks slopes to a snow platform, and is fitted with battens and guard rails, from the ends of which one guide rope supported on poles leads sharply to the right towards the meteorological screen, whilst the other shows the way to a cutting on the ice-foot, whence an easy path leads to the rocky patches on which stand our little group of huts. The main hut is of most imposing dimensions and would accommodate a very large party, but on account of its size and the necessity of economising coal it is very difficult to keep a working temperature inside; consequently it has not been available for some of the purposes for which we had hoped to

use it. One of the most important of these was the drying of clothes; for a long time the interior was hung with undergarments which had been washed on board, but all these water-sodden articles became sheets of ice, which only dried as the ice slowly evaporated. When it was found that this process took a fortnight or three weeks the idea was abandoned, and the drying of clothes is now done in the living-spaces on board. A drying-room would be an excellent thing to have on a polar expedition, and had the space under our forecastle been properly insulated and fitted with a stove it might well have served the purpose. As it is, with the present system, the dampness of the living-spaces must be increased, though, curiously enough, we do not notice it. We have erected long clothes-lines on each side of the wardroom, which carry a full *exposé* of our clothing economy, but whatever is ludicrous in this Arcadian simplicity, whatever is incongruous with the more artistic background, we have long ceased to notice. We find that we can eat our dinner with the usual regard to the forms of social politeness even when seated beneath our socks and nether garments.

'But although the hut has not fulfilled expectation in this respect, it is in constant use for other purposes. After the sledging it came in handy for drying the furs, tents, &c.; then it was devoted to the skinning of birds for a month or more, a canvas screen being placed close around the stove, whereby a reasonable temperature was maintained in a small space; then various sailorising jobs, such as the refitting of the awnings and the making of sword matting, were carried on in it; and finally it has been used both for the rehearsal and performance of such entertainments as have served to lighten the monotony of our routine, and in this capacity, when fitted with a stage and decked with scenery, footlights, &c., it probably forms the most pretentious theatre that has ever

been seen in polar regions. Of late a solid pedestal of firebricks has been built in the small compartment, and on this Bernacchi will shortly be swinging his pendulums for gravity observations; while in the spring I hope that we may be able to use the larger compartment as a centre for collecting, weighing, and distributing the food and equipment of the various sledge parties.

'On the whole, therefore, our large hut has been and will be of use to us, but its uses are never likely to be of such importance as to render it indispensable, nor cause it to be said that circumstances have justified the outlay made on it or the expenditure of space and trouble in bringing it to its final home. It is here now, however, and here it will stand for many a long year with such supplies as will afford the necessaries of life to any less fortunate party who may follow in our footsteps and be forced to search for food and shelter.

'Beyond the large hut stand the smaller magnetic huts, and from the eminence on that point the little cluster of buildings looks quite imposing. In the midst of these vast ice-solitudes and under the frowning desolation of the hills, the ship, the huts, the busy figures passing to and fro, and the various other evidences of human activity are extraordinarily impressive. How strange it all seems! For countless ages the great sombre mountains about us have loomed through the gloomy polar night with never an eye to mark their grandeur, and for countless ages the wind-swept snow has drifted over these great deserts with never a footprint to break its white surface; for one brief moment the eternal solitude is broken by a hive of human insects; for one brief moment they settle, eat, sleep, trample, and gaze, then they must be gone, and all must be surrendered again to the desolation of the ages.'

'*July* 19.— . . . One of the most important considerations for our comfort during the polar night is the manner

of lighting the ship. The breakdown of the windmill was a blow, as a supply of electric light would have been the greatest boon; but, luckily, we never over-estimated the possibility of success in this respect, and the breakdown found us amply supplied with alternative means. From the first, paraffin suggested itself as the most suitable illuminant for our purpose, and from the first also it had been decided to use this oil as fuel during our sledge journeys. On the other hand, paraffin is not a desirable oil to carry in a ship in any quantity, and in our case it was rendered less desirable by the fact that we had to take it at a low flash-point in order that it might remain liquid at the lowest temperatures. The flash-point of our oil is 105°, it begins to turn milky when the thermometer falls below −40°, and we have not yet experienced a temperature in which it will not flow freely.

'We decided in London that the best position to carry the large quantity which we required was on the upper deck, and consequently we had a number of tanks of considerable capacity constructed to fit into odd spaces where they would be least likely to obstruct the working of the ship. In this manner we managed to find room for over 1,500 gallons, which is now served out under the care of the engine-room department.

'Our luckiest find was perhaps the right sort of lamp in which to burn this oil. Fortunately an old Arctic explorer, Captain Egerton, presented me with a patent lamp in which the draught is produced by a fan worked by clockwork mechanism, and no chimney is needed. One could imagine the great mortality there would be in chimneys if we were obliged to employ them, so that when, on trial, this lamp was found to give an excellent light, others of the same sort were purchased, and we now use them exclusively in all parts of the ship with extremely satisfactory results. We also have on board a goodly number of candles, which are served out as

occasion requires; but over both oil and candles it is necessary to keep a very tight hold, as people are inclined to be extraordinarily wasteful.

'The necessity of heating the magnetic huts was not included in our estimate, and is therefore an unexpected drain on our resources; but apart from this our expenditure of both oil and candles is a great deal too large at present, and everyone has been warned that in case of a second winter the allowance will be largely curtailed. Although I realise that we are going too strong in this respect, I have not the heart to cut things down at present; the probability is we shall only do one winter; why not let it be as comfortable as possible? It is in the nature of a gamble, but if the worst comes to the worst, we can always fall back on blubber.'

It was perhaps a fortunate oversight that in the general comfort of our situation with regard to light we gave no thought to the adaptation of a still brighter illuminant which lay within our reach in the shape of acetylene. For when it became evident that we should have to spend a second winter in the same spot and there was no guarantee that this might not be prolonged to a third or even a fourth, the question of lighting the ship became a much more serious problem, and our thoughts flew at once to the calcium carbide which had been provided for the hut and which we had not previously thought of using. Once brought into working order, this illuminant proved to be the most delightful and the most easily worked that it would be possible to imagine. All that was necessary was to arrange a system of piping which led to the entrance porch; here the generator which regulated the mixture of the carbide with water, and so the production of gas, was placed, and here it continued to work in spite of the temperature, as the chemical action by which the gas was produced gave off sufficient heat to prevent the water from freezing on

the coldest days. In this manner the darkness of our second winter was relieved by a light of such brilliancy that all could pursue their occupations by the single burner placed in each compartment. I lay great stress on this, because I am confident that this is in every way the best illuminant that can be taken for a polar winter, and no future expedition should fail to supply themselves with it. The single drawback is the danger of carrying the carbide on shipboard. It must of necessity be kept in a dry place, but the danger can be greatly diminished by careful packing, and there is no reason why the sealed tins containing it should not be stowed in boxes, which are likewise made water-tight, and so assurance be made doubly sure.

I may mention that our stock of candles had also to be carefully considered in the second winter, and we thought it good policy to exaggerate our destitution to encourage greater care. As the result of a limited allowance it was possible to see widely different methods of consumption, and each person preserved with care a box in which he kept the grease which had guttered over from his own candles or from any others that he could lay his hands on. As soon as sufficient was collected he would set about casting fresh candles, and so eke out his own scanty supply; later it was found that by mixing this surplus grease with blubber still greater economy could be achieved, and in the end comparatively firm candles were made containing two parts of blubber to one of the original composition. Such are the teachings of adversity!

'The subjects of illumination and paraffin lead me naturally enough to consider the question of fire, which at first gave me some anxiety, and the adequacy of our pumps to meet this important contingency. During the summer cruise the ship continued to leak, the main hold slightly, the fore peak rapidly; this leakage continued for some time after we were frozen in, but gradually, as

the ice thickened around the ship, it diminished until finally it practically ceased. But our experience with the pumps in relieving the leak was sufficient to show their defects. Whilst the temperature was high they acted well, but when it fell they froze solid immediately after use, and to be brought into action again they had to be opened up, and thawed out with a blow-lamp, a task which occupied from twenty minutes to half-an-hour. Obviously it would be futile to rely on such pumps for coping with a fire during the winter, and I could see no possible object in keeping open a firehole in the ice on the vain supposition that we should then have water at our disposal. Consequently I had to consider the possibility of fighting a fire without water. Some reflection showed me that with a few precautions the risk of fire would be reduced to a minimum, and that if in spite of these it should break out, the strong probability was that it would be discovered at once.

'In the living-spaces safety lies in the fact that they are always occupied; with the additional safeguard of a box of earth it may be granted that a fire could not make any headway in these parts. On the rare occasions when people work in the holds or other parts there is always a responsible officer in charge, as well as the most stringent regulations with regard to lights. In the engine-room it would be very difficult to start a fire, and an officer goes round after working-hours to see that all is in order. Should fire occur despite such precautions our best means of coping with it would be to stifle it with fur and woollen clothing, of which there is always an abundance to hand. On the whole, one feels that there is much less risk of fire whilst the ship is steady than when she is knocking about at sea, but the grave consequences keep one always alive to the risk.'

'*July* 20.— . . . A southerly gale blew all yesterday and through the night, bringing quantities of snow, as

in May; the temperature rose as high as +12°, and all the out-stations show a corresponding increase. The fore-end of the awning was split, the boats entirely covered, and the drifts about the ship again raised to a height of ten or twelve feet. The fine snow penetrated everywhere; it raised our deck layer several inches under the awning, crowded in through a small ventilation hole in the magnetic observatory, completely covering the instruments, and snowed-up the kennels, the occupants of which have had to be temporarily housed on board. More than once our efforts to light the stove filled the wardroom with thick smoke, until we were glad to fly on deck for fresh air, and subsequently to go fireless. Luckily, the high temperature made this no great inconvenience. To-day the wind has gone back to the eastward, from which direction it sweeps along the loose snow with a rapidly falling temperature and a most comfortless outlook.'

'*July* 21.— . . . It was my "night on" last night. As I have said, we take it in turn to make all the two-hourly observations from 10 P.M. to 6 A.M. Each of us has his own way of passing the long, silent hours. My own custom is to devote some of it to laundry-work, and I must confess I make a very poor fist of it. However, with a bath full of hot water I commence pretty regularly after the ten o'clock observation, and labour away until my back aches. There is little difficulty with the handkerchiefs, socks, and such-like articles, but when it comes to thick woollen vests and pyjamas, I feel ready to own my incapacity; one always seems to be soaping and rubbing at the same place, and one is forced to wonder at the area of stuff which it takes to cover a comparatively small body. My work is never finished by midnight, but I generally pretend that it is, and after taking the observations for that hour, return to wring everything out. I am astonished to find that

even this is no light task: as one wrings out one end the water seems to fly to the other; then I hang some heavy garment on a hook and wring until I can wring no more; but even so, after it has been hung for a few minutes on the wardroom clothes-line, it will begin to drip merrily on the floor, and I have to tackle it afresh. I shall always have a high respect for laundry-work in future, but I do not think it can often have to cope with such thick garments as we wear.

'Washing over, one can devote oneself to pleasanter occupations. The night watchman is always allowed a box of sardines, which are scarce enough to be a great luxury, and is provided with tea or cocoa and a spirit-lamp. Everyone has his own ideas as to how sardines should be prepared, and of course puts them into practice when his turn of night duty comes, but the majority like them cooked in some form, so that nearly every night the sizzling of the frying-pan can be heard in the early hours and the odour of cooking is wafted into the adjacent cabins. I scarcely like to record that there is a small company of *gourmets* who actually wake one another up in order that the night watchman may present his fellow epicures with a small finger of buttered toast on which are poised two sardines "done to a turn." The awakened sleeper devours the dainty morsel, grunts his satisfaction, and goes placidly off into dreamland again.

'I find that after my labours at the wash-tub and the pleasing supper that follows, I can safely stretch myself out in a chair without fear of being overcome by sleep, and so, with the ever-soothing pipe and one's latest demand on the library bookshelves, one settles down in great peace and contentment whilst keeping an eye on the flying hours, ready to sally forth into the outer darkness at the appointed time. The pleasure or pain of that periodic journey is of course entirely dependent on the weather. On a fine night it may be quite a pleasure,

but when, as is more common, the wind is sweeping past the ship, the observer is often subjected to exasperating difficulties, and to conditions when his conscience must be at variance with his inclination. Sometimes the lantern will go out at the screen, and he is forced to return on board to light it; sometimes it will refuse to shine on the thin threads of mercury of the thermometer until it is obvious that his proximity has affected the reading, and he is forced to stand off until it has again fallen to the air temperature. He will climb to the indicator of the Robinson anemometer, and find it so difficult to see that the glass has frosted over before he has accomplished the reading, and he is obliged to scrape away the film of ice that covers it with his bare hand. Occasionally he has to cherish water with tender care against its freezing until he can re-wet the wet-bulb thermometer; and, again, he may have to remain stationary with upturned face for several minutes to determine the direction of motion of some elusive upper cloud. All these and many other difficulties in taking observations which may be in themselves valueless are met in the right spirit. I think we all appreciate that they are part of a greater whole whose value must stand or fall by attention to detail.'

'*July* 24.— . . . "Pipe, money, baccy, matches." I have forgotten the origin of this formula, but it is one which I have used for many years to remind myself of the indispensable contents of my pockets for a run on shore. I thought of it as I went out to-day, and, wondering what formula would replace it under present conditions, decided that there was none, as one has no requirement out of doors here but suitable apparel. Few, if any, smoke outside—in fact, it would be an impossible performance when the wind is blowing; and as for money, I look with mixed feelings at a sovereign which is gradually growing tarnished in the drawer of my desk; few

coins have had such a restful time as this sovereign—and for the matter of that, few persons such a restful time as its owner—but I expect for neither of us will there be much repose when we get back to civilisation. Meanwhile it is rather fascinating to consider the moneyless condition in which we live. With absence of wealth, community of interest, and a free sharing of comforts and hardships, we must realise much that is socialistically ideal, yet in recognition of rank and supremacy of command the government must be considered an autocracy; and, indeed, just at present I can the more fully realise my position as autocrat when I see how eagerly everyone is awaiting the sledging programme which is to foreshadow their lives for the coming season.

'Although no one smokes out of doors, many smoke within, and a few, amongst whom I must number myself, are inveterate victims of the habit. And yet, speaking generally, the consumption of tobacco is not so great as might be expected in the circumstances. Of eleven officers in the wardroom three are pretty constant smokers, four indulge moderately, and four are practically non-smokers. The first three may possibly consume about 1½ lb. each month, the moderate men may account for something over ½ lb. apiece, whilst the amount used by the remainder is practically negligible, so that the whole consumption for the eleven officers does not exceed 6 or 7 lbs. per month, at which rate our stock will last for many a year. On the mess-deck also there are a few who do not smoke at all, and many who are extremely moderate. The allowance is 1 lb. per month, and there has never been any request for an increase. No doubt the moderate smokers help those who are more addicted to the habit, but I should doubt whether any consume much more than their allowance, though from force of habit they prefer a very much stronger tobacco than that smoked aft, and in readiness

for this preference we shipped a quantity of tobacco in the leaf which has proved very popular; the men like rolling it up for themselves in the good old naval fashion. There is now little or no restriction as to time or place of smoking, and apart from the sympathy that I should naturally have with freedom in this respect as a great smoker myself, I cannot see that anything would be gained by limiting the practice as long as there is no one who is inconvenienced by it—and, luckily, we are in the happy position of possessing non-smokers who have not the least objection to sitting amongst many pipes.

'There is another habit indulged in by a few of the men which I thought had almost universally died out of fashion—namely, that of chewing. The objection to this, in my mind, is that it is carried on during the outdoor work, and it will, therefore, be a temptation for them to continue it during the sledging, and I feel sure that such a habit will detract from their marching powers. I have said nothing at present, but I propose that both smoking and chewing shall be forbidden on the march, and though a small allowance of tobacco will be permitted for smoking in camp, I hope to discourage chewing altogether.'

'*July* 25.— . . . The fourth number of our excellent monthly publication, the "South Polar Times," has recently appeared, and maintains the same excellence as former issues. The scheme for this publication was discussed long before the sun left us, and by general consent Shackleton was appointed editor. It was decided that each number should contain, besides the editorial, a summary of the events and meteorological conditions of the past month, certain scientifically instructive articles dealing with our work and our surroundings, and certain others written in a lighter vein. As the scheme developed it was found that other features, such as full-page caricatures, acrostics, and puzzles, could be

added; and now each month sees the production of a stout volume which is read with much interest and amusement by everyone. One of the pleasantest points with regard to it is that the men contribute as well as the officers; in fact, some of the best and quite the most amusing articles are written by the occupants of the mess-deck, of whom one or two show extraordinary ability with the pen. But beyond all else the journal owes its excellence to the principal artist, Wilson, who carries out the greater part of the illustration and produces drawings whose charm would be appreciated anywhere.

'Once or twice lately we have discussed the possibility of these volumes being interesting to a larger public, though there was no such idea in anyone's mind at the start. It is certain, however, that the journal is more ambitious in intention, and far more effective in its realisation, than any of its predecessors of the North Polar regions. On the one hand, we have some reading matter and many delightful sketches that would be appreciated by all; on the other, it has to be remembered that the humour and many of the references are local and would convey little or nothing to the uninformed reader, however much they may appeal to us "who are in the know." It is obvious that we cannot decide this matter for ourselves, but must take the opinion of outsiders more capable of judging.

'Before the appearance of the first number of the "S. P. T.," which came out with the departure of the sun, the editor had to face a rather delicate situation: it was announced that contributions need not be signed, but must be dropped into the editor's box by a certain date. When the date arrived it was found that the novelty of the venture had aroused such widespread interest that the box was crammed with manuscripts, and though there was not much difficulty in making a

selection, there was some danger of wounding the feelings of those literary aspirants whose contributions were rejected. In this dilemma the editor decided to issue a supplementary journal, to be named the "Blizzard," and one number of this redoubtable publication was produced, but fell so lamentably short of the "S. P. T." that the contributors realised that their mission in life did not lie in the paths of literary composition, and thereafter the editor's box contained only what that astute individual required for the original periodical.

'The anonymity of articles could not long be observed in such a small community, and after the appearance of the first numbers the style of different individuals was more or less easily recognised; but even the later numbers have contained some articles concerning the authorship of which there has been much erratic guessing. In mentioning the "Blizzard" I ought to remark that it has redeeming features in some capital line caricatures and a distinctly humorous frontispiece by Barne.'

'*July* 26.— . . . On the whole, the displays of the *aurora australis* have been disappointing; we had expected them to be more brilliant. When the sky is clear there is generally some auroral light, but it is rarely vivid, and never bright enough to be photographed. In hopes of obtaining the spectrum of this light, a rapid plate has been exposed to it for hours, and even days together, but as yet there has not been the least impression on it. In general the light is so faint that stars of even a small magnitude can be seen distinctly through it; but of late there has been an improvement, and the contrast on the dark nights has given us a very beautiful, if not a very brilliant, effect to the southward. Lately it has commenced about three by a bright but low curtain to the E.N.E., where unfortunately the hills partly hide the view; but later it seems to spread up and towards the south, so that usually in the evening there are

shafts and patches of light scattered about in full view of the ship with sometimes a well-formed corona to the south.

'Often when the weather has been calm and clear I have been up and over the hills in the afternoon to see the easterly display. There is something very weird and awe-inspiring in a phenomenon so fleeting, so intangible and so difficult to describe. The light grows and wanes, but one cannot mark the moment of its coming or its going. It distinctly moves, but one cannot say how; sometimes it appears to roll forward or to the side, sometimes it seems to spread itself as though anxious for greater space. For no two instants is it the same, and yet the change is so subtle that one cannot grasp it until some new development has robbed one of the picture.

'As I arrived on the hill summit to-day the sky was clear and dark, but as I walked forward a narrow arched band of light appeared across the east; it seemed to rise, to halt. Little fibrous shafts spread out above and below; a moment more, and the fibres became luminous cloud masses rolling towards the south; in the next they had ceased to move; the light was spreading and waning, was gone. Then shafts of light flashed up like mighty search-light beams cast to the zenith; but before I could well note them, they were bent in fantastic convolutions, some curling to spiral columns. In a few moments all this had come and gone, and the broad clean arch of a corona seemed to be rushing towards me from the south. As it rose, a second arch flashed up beneath; then, as though some giant hand had swept across the skies, the whole scene was changed, and only some vague luminous patches remained.

'It appears to me that the sharpest contrasts are formed by the vertical shafts, or at the lower edge of the arches where the light is brightest and is clearly outlined

against the vaulted blue of the sky; elsewhere the light merges indefinitely into shade.

'Since the phenomenon of the aurora has been reproduced artificially, its study has advanced to a stage rather beyond the comprehension of the ordinary man, and after the countless observations which have been made in the North it does not seem likely that our observations or any observations of the actual phenomenon itself can add greatly to our knowledge; but considering that the luminosity of the aurora must be an electrical effect closely connected with the magnetism of the earth, it may be of some interest that in our observation it always appears to the south-east or away from the magnetic pole. The auroral light is usually a pure white, but we have observed it with a distinct green tinge, and on rare occasions with a reddish shade. Last night there were large patches of light in the zenith, and, what is also rare, several shafts in the west.'

'*July* 28.— . . . The latest southerly gale has awakened us to a most unpleasant fact, though at present it is impossible to gauge the exact extent of our difficulty. The question of the moment is, What has become of our boats? Early in the winter they were hoisted out to give more room for the awning, and were placed in a line about 100 yards from the ice-foot on the sea-ice. The earliest gale drifted them up nearly gunwale high, and thus for two months they remained in sight whilst we congratulated ourselves on their security. The last gale brought more snow, and, piling it in drifts at various places in the bay, chose to be specially generous with it in the neighbourhood of our boats, so that afterwards they were found to be buried three or four feet beneath the new surface. Although we had noted with interest the manner in which the extra weight of snow in other places was pressing down the surface of the original ice, and were even taking measurements of the effects thus

produced, we remained fatuously blind to the risks our boats ran under such conditions. It was from no feeling of anxiety, but rather to provide occupation, that I directed that the snow on top of them should be removed, and it was not until we had dug down to the first boat that the true state of affairs dawned on us. She was found lying in a mass of slushy ice, with which also she was nearly filled. For the moment we had a wild hope that she could be pulled up, but by the time we could rig shears the air temperature had converted the slush into hardened ice, and she was found to be stuck fast. At present there is no hope of recovering any of the boats: as fast as one could dig out the sodden ice, more sea-water would flow in and freeze. The only hope is to prevent bad going to worse before the summer brings more hopeful conditions. The danger is that fresh gales bringing more snow will sink them so far beneath the surface that we shall be unable to recover them at all. Stuck solid in the floe they must go down with it, and every effort must be devoted to preventing the floe from sinking. At present all hands are removing the snow on top of the boats and for a distance of ten yards around, and are forming a snow-wall on the outskirts of this area. It is a long job, and will probably have to be repeated after every gale. Meanwhile our stupidity has landed us in a pretty bad hole, for we may have to leave this spot without a single boat in the ship.'

From this time we had a hard fight for our boats. Day after day parties were digging away at their snow covering, and in the course of months many tons must have been removed. After each gale our hearts sank, as to all appearance we were forced to begin all over again; but we knew that, although there was so little to show for our labours, our work must tell in the long run, and that in it lay the only hope of keeping the boats within our grasp until the climate should be more favourable. So,

however deeply the snow fell after each new southerly blow, the work was renewed with vigour, and we bowed to the inevitable whilst we heartily cursed the folly which had landed us in such a predicament. It was not until December, five months later, that Mr. Royds and our excellent boatswain were able to attack the question of release with any chance of success, and it was in this month that, after much sawing and blasting, the boats were finally liberated, though by no means without injury.

'*August* 1.—There can be few scenes more beautiful than that which is about us on a calm moonlight night. During the noon hours the silver rays are lost, and the moon itself is changed to a deep orange yellow in the diffused twilight cast by the gleaming crimson band to the north; but as the red glow slowly travels around and is lost behind the western hills, our white world is left alone with the moon and the stars. The cold, white light falls on the colder, whiter snow against which the dark rock and intricate outline of the ship stand out in blackest contrast. Each sharp peak and every object about us casts a deep shadow, and is clearly outlined against the sky, but beyond our immediate surroundings is fairyland. The eye travels on and on over the gleaming plain till it meets the misty white horizon, and above and beyond, the soft, silvery outlines of the mountains. Did one not know them of old, it would sometimes be difficult to think them real, so deep a spell of enchantment seems to rest on the scene. And indeed it is not a spell that rests on man alone, for it is on such nights that the dogs lift up their voices and join in a chant which disturbs the most restful sleepers.

'What lingering instinct of bygone ages can impel them to this extraordinary custom is beyond guessing; but on these calm, clear moonlit nights, when all are coiled down placidly sleeping, one will suddenly raise

his head and from the depths of his throat send forth a prolonged, dismal wail, utterly unlike any sound he can produce on ordinary occasions. As the note dies away another animal takes it up, and then another and another, until the hills re-echo with the same unutterably dreary plaint. There is no undue haste and no snapping or snarling, which makes it very evident that this is a solemn function, some sacred rite which must be performed in these circumstances. If one is sentimentally inclined, as may be forgiven on such a night, this chorus almost seems to possess the woes of the ages; as an accompaniment to the vast desolation without, it touches the lowest depths of sadness.

'But if one is not sentimentally inclined, and rather bent on refreshing sleep, it possesses so little charm that one endeavours to correct matters by shouts and pieces of ice. As a rule the animals are so absorbed in their occupation and so lost to their surroundings that even these monitions have no power to disturb them, and one has at length to bribe them basely with a biscuit or a piece of seal-meat.

'Generally in calm, bright weather, the temperature is low, and to-night, when the thermometer stood below $-40°$, we observed a curious fact which I do not remember to have seen mentioned before. If one is standing still and bareheaded, and exhales a deep breath, one can actually hear one's breath freezing a moment or two after it has left the mouth. What one hears I do not precisely know, unless the actual formation of ice-crystals produces a sound, as appears to be the case. The sound itself is not easy to describe; it is rather like that produced by the movement of sand on a beach when a wave washes up. Koettlitz says it is like the minutest crepitations, and though few of us knew what the word meant till we consulted the dictionary, we have adopted his description.

'A curious effect of the cold snaps is a mist which arises off the land, very thin and very white, and in the silvery moonlight beautiful beyond description. It spreads like the finest gauze-web over the sharp outlines of the near hills; the white snow-slopes and dark shadows of the rocks are softened in its shimmering folds, and seem to rest on the lightest foundations of silvery cloud.'

'*August* 4.— . . . The driving snow has again enveloped everything. The boat clearance is covered. The only thing is to go on steadily digging away at it; but if the snowfall continues in the spring it will mean a lot of work. Still, by hook or by crook the boats must be kept above water. We now feel a great drawback in the scarcity of picks and shovels. It is wonderful what has been done already with the mere dozen which were supplied, considering that they have been in use every day and all day; but a good many are now hopelessly broken, and the remainder are not very efficient. We shall have to rely on the engine-room department once more, but although they can make shovels, I doubt if they will be able to cope with the picks for want of materials. The temperature since the gale has been extraordinarily high. To-day it has been above zero, and light snow is falling. The daylight is coming on apace; at noon, when it is cloudless, the details of the land can be seen very clearly on all sides, and it is pleasant to be out when the snow is not driving.

'Bernacchi and Skelton are just completing a set of pendulum observations in the main hut, and last night when the gale was rising with blinding drift they had an adventure from which they were extremely lucky to escape unscathed. In the evening the hut was fully occupied, Bernacchi and Skelton being at work in the smaller compartment, whilst Royds was busily rehearsing his nigger minstrel troupe in the larger one; but shortly after the rehearsal began, either because it proved a

somewhat disturbing element or because their work was finished, the two scientific workers left to return to the ship. It was fully an hour and a half after this that, the rehearsal being finished, Royds and his party, numbering more than a dozen, started back. They found that the gale had increased, and that in the whirling snow they could see nothing; but, being in such numbers, they were able to join hands and sweep along until they caught the guide rope leading to the gangway. As they travelled along it, they heard feeble shouts wafted on the storm, and again extending their line they swept on in a chain and suddenly fell on Bernacchi and Skelton, who, although they had left the hut an hour and a half before, had entirely lost their bearings and were reduced to shouting on the poor chance of being heard and rescued.

'Meanwhile on board the ship we had not the smallest suspicion that anything unusual had taken place, and remained in ignorance until the rescuers and the rescued burst in upon us; the latter were severely frost-bitten about the face and also in the legs, as they had not been prepared for such a long stay in the open; and as they had not been provided with wind covering, their garments inside and out were thickly coated with ice and snow. As soon as we had revived them we learnt what little tale they had to tell.

'On leaving the hut they had started for the ship, steering through the blinding drift as best they could. After walking for some distance they came to the conclusion they must have missed her, and proceeded to grope their way back to the land. When they reached the tide crack they found some difficulty in deciding which way they should go, but finally they reached a spot which they recognised, and, calculating the position of the ship, they again made tracks for her, and again found that they had missed the mark. They then decided to try to search around in circles, and so the time passed

whilst they wandered more or less aimlessly about until they became alarmed, and tried to attract attention by shouting. In the nick of time they were rescued within thirty yards of their goal, but without any knowledge of the fact.

'The hut is certainly not more than 200 yards from the ship, and the ship is not only a comparatively big object, but is surrounded by guide ropes and other objects which if encountered would have informed the wanderers of their position. These officers were neither of them likely to have lost their heads, and both might be trusted to take the most practical course in such a difficulty. In these circumstances the fact that they should have been lost for two hours would have been incredible had it not actually occurred. It is the most convincing lesson on the blinding, bewildering effect of a blizzard that we have had, and shows clearly what care will be necessary with our sledge parties if such weather continues in the spring. Throughout the greater part of the winter we have had a guide rope which continued as far as the hut, and had this been in order last night all trouble would have been avoided; but recently it has sagged between the poles and become buried beneath the snow, and it was not available, therefore, for parties leaving the hut.'

Throughout our stay in these regions I had constantly a lurking anxiety that disaster might attend the overbold habits of some of our officers in making long excursions from the ship, especially during the winter months. The trouble lay chiefly in the impossibility of predicting the weather conditions; the barometer told nothing, and such other signs of bad weather as came under our observation were so uncertain that it was impossible to legislate on them. Threats of a storm were so constantly unfulfilled that to have kept all hands within bounds on their account would have been irksome to individual feeling and discouraging to individual work. The only

satisfactory course was to rely on the discretion of distant workers to hasten home directly the weather looked ugly, and to trust that the coming storm would not develop before they had reached a position of safety; but, needless to remark, this happy result was not always realised, and my diary throughout the two years records many hours of anxiety caused by the prolonged absence of some person, and some occasions on which search parties were rapidly organised to find such a belated worker. In the course of time this naturally became an easier task, as we all became better acquainted with the features of the tide crack and the various patches of rock and with their relative bearings. In course of time also our system of relief became better organised; and although we did not put it in practice, it may be well to record our final arrangement in this respect as a hint to those who may live under like conditions in the future. In outline our ultimate plan for searching was to spread out the search party in a very extended order, connecting them by a fine strong line, and so to sweep round the floe systematically until the object of our search was recovered.

Experiences of this sort taught us the valuable lesson of never leaving our sledges on our long sledge journeys except under the most favourable conditions. It can be imagined that one was often tempted to do this to get a better knowledge of some object which lay off the line of march, but when such a *détour* became necessary, wisdom suggested that the sledges should be taken as far as possible towards the object, even if the ground were rough; and although we often marched in threatening and stormy weather, it was always with our temporary home behind us.

The idea of requisitioning our large hut as a place of entertainment had occurred to us early in the winter, and in this connection it was first used for a concert

given during the first week in May. Royds, who took much pains in getting up this function, arranged a long programme in order to bring forth all the available talent; but although we were not inclined to be critical of our amusements, one was fain to confess that our company had not been chosen for their musical attainments. However, there were exceptions to the mediocrity, and some exhibition of dramatic talent, which prompted the conception of a modified entertainment for a future occasion; so Barne was entrusted with the task of producing a play, and after much casting about succeeded in getting his company together. All became very diligent with rehearsals, and as these were conducted in the hut with all due secrecy, the audience remained in ignorance of even the name of the play until the night of its production. It was decided that this should be immediately after our mid-winter celebrations, and my diary for June 25 gives some account of this great night:

'At seven to-night we all journey across to the hut, forcing our way through a rather keen wind and light snowdrift. The theatre within looks bright and cheerful, but as there are no heating arrangements other than the lamps, one conquers the natural instinct to take off one's overcoat and head covering, and decides that it will be wise to retain these garments throughout the performance. On one side of the large compartment a fair-sized stage has been erected, raised some two feet above the floor; the edge is decorated with a goodly row of footlights, immediately behind which hangs a drop-curtain depicting the ship and Mount Erebus in glowing colours, and boldly informing one that this is the "Royal Terror Theatre." The remainder of the compartment forms an auditorium of ample size to accommodate all who are not performing, with a stray dog or two brought in to enliven the proceedings.

'In front stands a row of chairs for the officers, and behind several rows of benches for the men; the apartment is lighted by a large oil lamp, and when all are seated one must own to having seen theatricals under far less realistic conditions. When all are seated also, and when pipes are lit, there is a perceptible improvement in the temperature, a condition that one feels will be very welcome to the lightly clad actors.

'In due course programmes are passed round, informing us that Part I. will consist of several songs rendered by popular singers, and that for Part II. we shall have the "Ticket of Leave," "a screaming comedy in one act." These programmes, I may remark, are correct at least in one respect, in that there is some difficulty in picking out the information from amongst the mass of advertisements. Presently the curtain rolls up and discloses Royds at the piano and the first singers in true concert attitude. We have a duet, followed by several solos, and occasionally a rousing chorus, when one rather fears that the roof of the Royal Terror Theatre will rise. On the whole the first part passes decorously, and we come to the interval, when the wags advertise oranges and nuts.

'Then we have Part II., which is what we are here for: the "screaming comedy" commences and proves to be fully up to its title. There is no need for the actors to speak—their appearance is quite enough to secure the applause of the audience; and when the representatives of the lady parts step on to the stage it is useless for them to attempt speech for several minutes, the audience is so hugely delighted. Thanks to Mr. Clarkson and his make-up box, the disguises are excellent, and it soon becomes evident that the actors have regarded them as by far the most important part of the proceedings, and hold the view that it is rather a waste of time to learn a part when one has a good loud-voiced prompter. As

the play progresses one supposes there is a plot, but it is a little difficult to unravel. Presently, however, we are obviously working up to a situation; the hero, or perhaps I should say one of the heroes (for each actor at least attacks his part with heroism), unexpectedly sees through the window the lady on whom he has fixed his affections, and whom, I gather, he has not seen for a long and weary time. He is evidently a little uncertain as to her identity, and at this stirring moment he sits very carefully on a chair—he almost dusts the seat before he does so. Seated and barely glancing at the window, he says with great deliberation and in the most matter-of-fact tones, "It is—no, it isn't—yes, it is—it is my long-lost Mary Jane." The sentiment—or the rendering of it—is greeted with shouts of applause. Later on we work up to a climax, when it is evident that the services of the police force will be required. This part is much more to the taste of the players; somebody has to be chucked out; both he and the "chuckers-out" determine to make their parts quite realistic, and for several minutes there is practically a free fight with imminent risk to the furniture. And so at last the curtain falls amidst vociferous cheering, and I for one have to acknowledge that I have rarely been so gorgeously entertained. With renewed cheers we break up and wander back to the ship, after having witnessed what the "S. P. T." may veraciously describe as "one of the most successful entertainments ever given within the Polar Circle"—and indeed they might with some truth add "or anywhere else."'

From the above it will be seen that our first essay at acting met with very hearty approval, if it did not show us to be possessed of great histrionic talent. We had always intended to call again on our dramatic company, but owing to the work of several of its members and other circumstances our plans slipped through; later on,

however, Royds undertook to organise a nigger minstrel troupe, and towards the end of the winter succeeded in getting them together and in rehearsing their various parts through many a cold hour spent in the freezing theatre.

On August 6, the date fixed for this performance, we were in the midst of a cold snap, but although the temperature had fallen below −40°, it was decided that the programme should be carried out as intended.

'To-night the doors of the Royal Terror Theatre opened at 7.30, and as the temperature was −40° and there was a strong wind, everybody did his best to make a record in reaching it. Even inside the temperature must have been well below zero; I wonder how the ordinary theatre-goer would appreciate sitting in stalls under such conditions.

'One was not sorry when the curtain rolled up and disclosed our twelve minstrels with blackened faces sitting in a row with "Massa Johnson" in the centre. A programme with an illustrated cover informed us that this was the "Dishcover Minstrel Troupe." There is no doubt the sailors dearly love to make up; on this occasion they had taken an infinity of trouble to prepare themselves; calicoes of all sorts had been cut up and sewn together to make suits of the most vivid colours and grotesque form; shirt fronts and enormous collars of elaborate design had been made from paper; wigs had been manufactured from tow, in some cases dipped in red ink, and an equal ingenuity had been displayed in producing the enormous boots and buttons which constitute an important part of the nigger minstrel's costume. "Bones" and "Skins" had even gone so far as to provide themselves with movable top-knots which could be worked at effective moments by pulling a string below.

'As everyone knows, a nigger minstrel performance

consists of a number of songs and choruses, between which the ball of conversation is kept rolling amongst the various minstrels in the form of weighty conundrums, which, after numerous futile attempts from others, are usually answered by the propounder himself. I don't know why a joke should sound better in nigger language, but I rather think the class of joke made on these occasions does so.

'To-night the choruses and plantation songs led by Royds were really well sung, and they repay him for the very great pains that he has taken in the rehearsals. Of course in the choruses of "Marching through Georgia," "Golden Slippers," "Suwanee River," and such songs, the audience felt that they must also "lend a hand," and did so with such a will that the rafters shook. The jokes were nearly all home-made and topical, but amused us none the less for that; everyone had some sly shaft of wit aimed at him, but all in the best of good humour, and so the merry jests went round until something had been said about the ship, the dogs, the windmill, the people, and every imaginable or unimaginable thing about us, and on the whole they afforded us a good deal of hearty laughter.

'I can remember but few of these jocular efforts; I recollect that the cook was likened to a cooper round a cask—because he was always going round "doing a tap." Another question which puzzled me for some time was, "Can you told me, Massa Bones, what am de best way to clear lower-deck in de Dishcubry?" Bones suggested that it was to turn on a southerly wind (when the stoves began to smoke badly), but the correct answer was much truer: "You tak' an' open a tin of ——'s Brussels sprouts." Another, and perhaps better, question was, "Can you told me what am de worst vegetable as we took from Englan'?" One naturally thought

that some such answer as the above might have fitted here, but the proper reply was stated to be "The Dundee leak." When we got back to the ship after the performance we decided that in spite of the cold we had spent an extremely pleasant evening.'

'*August* 7.—The cold snap continues, and to-day is calm. Barne is far out with a small sledge and sounding machine; Shackleton and Hodgson still further, digging up a fish trap. Many others are scattered about in various directions, and all rejoicing in the absence of wind. The sky is clear overhead and the light fairly good, but to the north hangs a yellowish brown haze, now rather common. It seemed to grow colder as I went outwards over the floe, and a light wind persistently attacked my most vulnerable feature, my nostrils. I could feel them pricking and tingling on the road to frost-bite, but as I was talking to Barne on my way back this feeling suddenly ceased, the air seemed to grow much warmer, and on going to the screen I found the temperature was $-36°$, whereas a short time before I had left it at $-51\frac{1}{2}°$. It was a striking example of the waves of temperature that occur in this comparatively calm, clear weather. Koettlitz, who has been to his thermometer off the cape, reports a minimum of $-62°$ and a present temperature of $-57.5°$, which is probably the degree of cold in which Shackleton and Hodgson are now labouring to clear the latter's fish trap, a task in which they are consequently not much to be envied. The cold is pushing through the weak spots in our defences below, and makes itself known as usual by an increase of ice on the bulkheads and over the bolts, but we have not much difficulty in keeping the air in the wardroom up to 50°.'

'*August* 9.—Preparations for sledging are being pushed on apace; it is astonishing what a lot of time and attention it all takes.

'There is now a bright orange light to the northward at noon, and each day brings a nearer approach of the sun; in a week we shall have good light for several hours, and in a fortnight we shall be welcoming back the sun.

'The result of the snowless wind which we have had of late has been to harden and polish the surfaces of the floes and the hill slopes. I find it impossible to maintain footing on slopes which I could climb easily a fortnight ago. Seals have ceased to appear on the ice for a long time, but they are still about beneath it, and can be heard at the tide cracks and at their snow-covered breathing-holes; occasionally they come under the ship and give a prolonged whining snort, unlike any sound one can recall, but which can be distinctly heard within. In the early winter we were much puzzled by this noise, and many declared that it was caused by the ice, but we have since traced it without doubt to the seals.

Many times lately we have heard mysterious noises on deck when the temperature is falling. Amidst the sharp crackling of the rigging which always accompanies this condition, there is occasionally a loud report like the fall of some heavy weight. In whatever cabin one may be, it seems to be immediately overhead. Again and again we have dashed on deck to discover the cause, but always without result. It is so uncanny that we now feel confident that it is the manifestation of our own particular ghost.'

'*August* 12.—Another blizzard, so thick that one cannot see one's hand before one's face. Two days ago we had almost cleared the snow from off the boats; now they will be completely covered again. No one goes out on these occasions; the drifting snow has very much the effect of a sandblast—it positively pricks the skin and brings frost-bites with alarming rapidity. Though it is now moderately light at noon, we could see

nothing to-day but a whitening of the whirling cloud about us. The dogs, whose kennels were likely to be drifted up, were brought on board early in the storm; they are generally rather sad and subdued on such occasions, and can be safely huddled together without fear of a fight, always excepting the redoubtable "Nigger," who is given a corner to himself. With him action follows so quickly on thought, and is so immediately effective, that it is considered advisable to take no risks.'

'*August* 13.— . . . Walked to-day round the cape to Pram Point; it is between three and four miles from the ship, and is a spot that has been visited by us often throughout the winter. A little beyond this point lies the limiting line up to which the sea-ice broke away in the autumn, and consequently on the farther side of this line lies ice of an unknown age whose surface gradually rises to the level of the barrier, whereas on the near side the ice is all of recent formation. The centre of interest lies in the ridges which have formed and are continuing to form in this region. The coastline beyond the point runs towards Erebus, only slightly curving, and fringed with steep ice-cliffs and crevassed slopes.

'The ridges in the ice are parallel to each other and to the coastline, and extend for a considerable distance along it. From the heights above they look like heavy, round-crested rollers of the sea that are preparing to fling themselves on the shore, so smooth and regular do their undulations appear, and so gradually are they lost in the plain beyond; and from the same heights also they have frequently been counted, and I think most of us have made their number to be seventeen. But amongst the ridges it is possible to see that their summits are cracked in an irregular fashion, and that they are by no means regular in height. This may well be accounted for by the varying amount of snow which has fallen in the hollows. To-day I measured two of these ridges

from crest to hollow, and found one to be 18 feet, whilst another nearer the shore was 14 feet. There can be little doubt that this formation is due to the ice-sheet pressing up from the south; and, large as the disturbance is, when the mighty nature of the cause is considered, it vanishes into insignificance.

'Whatever the cause may be, it is still active, for the freshly formed ice to the southward is gradually being waved up in the same fashion. The whole thing is puzzling, because one is at a loss to account for the absence of ridges further to the north, and because, if this is a measure of the movement of the great ice-sheet, that movement must be extremely small, as the whole extent of the pressing-up of the new sea-ice cannot be more than a collapse of twenty or thirty yards at the outside. In any case it will be an interesting thing to watch for further developments in this movement, and to see whether there is any difference in its rate in summer.'

What was at this time comparatively new sea-ice remained fast throughout the following winter, and we saw the ridges in it gradually rising in a slow, silent, uncanny fashion, until they presented a huge confusion of upreared ice-blocks.

'*August* 16.— . . . We have now three litters of puppies in various stages of development. "Vincka," Armitage's pet Samoyede, has four which were born a month ago and are now capable of snarling and snapping on their own account. "Blanco" produced five on the 11th. She has since succeeded in killing two, but the remainder of her family are just opening their eyes on this strange new world and rolling about their warm nest with shrill squeals. To-day "Nell" has added seven to the puppy population; they look like seven little blind rats, but she guards them very jealously with ominous growls when anyone approaches. We shall

probably reduce this last litter to four or five, and so remain the possessors of about a dozen in all.

'Each mother has her own comfortable nest under the shelter of the forecastle, and gets sufficient warmth from the straw and sacking which are plentifully distributed about it. "Vincky" takes her maternal duties very lightly, and spends the day in teasing her offspring, apparently under the impression that they exist to romp with her. But her pups don't see it in the same light: their small minds are seriously bent on exploration, and they become so annoyed at their mother's levity that they growl and snap at all her playful efforts, and occasionally fly into paroxysms of rage. "Blanco" is a lady possessed of much low cunning, which has made her very unpopular with the men. It was not expected that she would prove a good mother, and she certainly is not; her three small mites would find it hard to get a living without human assistance. But "Nell" promises to be in all respects a model parent. She has always possessed a very uncertain temper, and the responsibilities of a family have rendered her absolutely fierce. One has to approach her nest with great caution and be extremely careful not to do anything that she may consider suspicious; but when she is assured that one's intentions are friendly, she will condescend to accept ministrations to her wants.

'We have had "Brownie," another of the dogs, under shelter for some time; he is a very handsome beast, with nice affectionate manners which make him rather a pet with all, so that when he was found shivering violently in the cold, pity was taken on him and he was brought under the forecastle. Careful observation, however, showed that he is really rather a rascal, and that he is in the habit of putting on his shivering fits when anyone appears in sight; he is evidently aware that if he is taken on board he will not only get a warmer nest, but

certain tit-bits which his soul desires. So to-day we have hardened our hearts and put him out again.

'There is a world of character in these animals of ours. One of the greatest pities is that they cannot be made to follow or to obey a word of command unless they are in harness. They are great losers by it in missing many a walk. To lead them continually about on a string is very trying, as they pull hard the whole time, and it is odds that the dog rather than the man directs the course of the walk; at other times they will be particularly meek and ingratiating, trotting alongside and pressing their noses into one's mit, all in the most companionable spirit, until one rashly slips the leash, when in a moment they are off on their own devices, and are seen no more until a wild hubbub at the kennels signifies their return, and someone has to rush out to prevent a fight.

'The sport they most dearly love is to worry a seal. The hunting instinct is paramount; the most listless, weary, bored-looking dog or team of dogs has only to catch sight of the black dots afar off over the snow which signify the presence of seals, to become electrified into a state of wild excitement. If a person has a single animal on leash, the chances are that he is caught unprepared and the next moment finds himself without a dog or being dragged violently along on his stomach: if he is with a team harnessed to a heavy sledge, a load which a moment before appeared to be taking all heart out of the animals, becomes the merest bagatelle, and he is lucky if he has time to add his own weight and so prevent himself from being left behind.

In the early part of the winter, when the seals came up frequently, loose dogs immediately made for their haunts, and the distant furious barking would soon tell what was going forward. We did our best to capture these stray animals and prevent the slaughter of the

our community can make certain of receiving critical attention and outspoken advice, and in this case there was no reticence at all. Advice was most freely given, but it was generally to the effect that it would be kind to remove such an eyesore by immediate burial and oblivion. But the inventor refused to be drawn, and rolled his machine with difficulty, but with the light of enthusiasm still burning in his eye. It was the queerest sort of arrangement, consisting of two rum-barrels placed one in front of the other and acting as wheels to a framework on which the load was intended to be placed; the manner in which the whole machine wobbled as it was pushed forward on such ungainly rollers can be well imagined. This new toy continued to give pleasure to the inventor, and incidentally to many others, for some hours; and as I came in, Barne was assisting Shackleton to rig it with the dinghy's sails—I do not know with what success, but I can very well imagine.'

Of course this machine was very soon neglected and forgotten, but in justice to the inventor it ought to be added that there were times when the snow surface about us was so hard that it would have been quite possible to resort to wheeled traffic, and I am sure that for many purposes a very light cart with broad-tyred wheels would have been extremely useful. But I cannot conceive that a rum-cask would ever prove a desirable addition to a vehicle!

'*August* 21.— . . . The sun returns to us to-day, but alas and alack! we could get no sight of it. A few hours of calm in the morning were succeeded by whirling snow-squalls from the south, and each lull was followed by a wild burst of wind. I was glad enough to have everyone on board under such unsettled conditions, and at noon, when we had hoped to be far over the hills, we could see only vast sheets of gleaming snow.

'*August* 22.— . . . An ideal day for our first view of the

long-absent sun: the sky was gloriously clear, and in its vaulted arch the strong returning light of day hid all except the brightest stars, and these wore but a pale semblance of their winter aspect. The air was mild and the temperature ranging up to 5°, as, in high spirits, many of the officers started to mount the steep hill-slopes, determined to have a good look at our long-absent friend. I went myself to the top of Crater Hill, a thousand feet above the floe, to watch for the returning orb; at noon, when it was due north, it rested behind the long foot-slope of Erebus, but as it travelled westward its altitude decreased far less rapidly than that of the slope, and gradually the refracted glowing ellipse crept from behind that obstacle and stood clear, dazzling our unaccustomed sight with its brilliancy. For long our blinking eyes remained fixed on that golden ball and on the fiery track of its reflection; we seemed to bathe in that brilliant flood of light, and from its flashing rays to drink in new life, new strength, and new hope. This glorious sun was bringing the light of day and some measure of warmth to the bleak, desolate region about us, and heaven only knows how far prophetic thoughts took us over its trackless wastes before those beneficent rays should again vanish and sombre darkness once more descend. And so we gazed, saying little but thinking much, until the chill of the air reminded us that, however great the promise, summer itself was not yet upon us.

'With full daylight each detail of our landscape once more stands clear, and the view from Crater Hill is magnificent.

'From Arrival Bay a line of rocky ridges runs towards Castle Rock, facing the north-west and gradually rising in height, with four distinct eminences, of which two are well-formed craters; the fourth is almost on a level with Crater Hill, and therefore nearly touches the sky-line; behind it Castle Rock, rising to 1,350 feet, shows in sharp

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precipitous outline, a black shadow against the snowy background of Erebus. It is a high, hilly country, this foreground, with many a black mass of rock and many a slope of smooth white snow; in itself it might be called a fine rugged scene, but how dwarfed it all is by that mighty mountain behind, which, in spite of its twenty geographical miles of distance, seems to frown down on us. Even Castle Rock, with its near bold eminence, is but a pigmy to this giant mass, which from its broad spreading foot-slopes rises, with fold on fold of snowy whiteness, to its crater summit, where, 13,000 feet above the sea, it is crowned with a golden cloud of rolling vapour.

'The eastern slope of Erebus dips to a high saddle-backed divide, beyond which the snowy outline rises to the summit of Terror, whence a long slope runs gradually down to sea-level far to the east. From point to point these two huge mountains fill up nearly 90° of our horizon, and from this southern side offer almost a complete prospect of snow-covered land. Beyond Castle Rock commences the low isthmus which connects our small peninsula to the main island, and as it bends slightly to the east it can be seen from Crater Hill. In running towards the right slope of Erebus and gradually broadening to its foot-slopes, it sweeps out on either side a huge bay.

'The eastern bay is filled with the perpetual level plain of the fast barrier-ice; scarce a vestige of bare rock is to be seen in the vast extent of its coastline, and it would appear that climatic conditions have rendered it a focus for snow, though an area little swept by wind; the mere view in this direction suggests the idea, and the experience of the Terror sledge party goes far to substantiate it.

'The western bay is cleared of ice in the summer; its northern limit is marked by a bare rocky cape, and in a few other spots on its coastline the bare rock stands boldly out. Three black volcanic islets stand well within

its shelter, and it is to these that the open water has extended since the late gales. This open water is now again frozen over, but the dark colour of the young ice forms a strong contrast to the older snow-covered surface, and this darker shade stretches to the north-west beyond sight.

'Looking to the eastward from Crater Hill, one has Pram Point almost beneath one's feet, and one gets a good view of the regular parallel ridges that fringe the coast; beyond these ridges stretches the immeasurable barrier surface, limited to the eye by one long clear sweep of perfectly regular horizon stretching from the eastern slopes of Terror through more than 70° of arc to the eastern slope of White Island. Beyond this long stretch of uniformity the eye can follow the sky-line over the three comparatively low craters of the White Island, till it dips once more for a short space to the horizontal, and rises over the sharp steep end of the distant bluff. One is now looking south, in the direction which involves most of our hopes and fears; and as one gazes on the light shades of the distant snow-fields, one realises the impotence of speculating on what may lie beyond, and grows ever more impatient for the hour when we shall march forth with the high hope of solving the mystery.

'Leaving the south once more, the eye, following the sky-line, passes on over the high outline of Black Island, if island it is, and then rises and traverses the lofty peaked cone of Mount Discovery, from which it falls slightly to an elevated saddle-back; and then suddenly it travels to a far greater distance, and towards the south-west it rests on very distant hills in front of which a huge glacier descends to sea-level. Here one pauses to consider, for this also may be a direction of promise. Can this be the road to the west, the path by which we shall pierce that rock-bound coastline? Again one sees the futility of speculation: we must go and see.

'Meanwhile the eye has passed on to scan that great frowning range of mountains to the west which has looked down on us in such ghostly, weird fashion throughout the winter months. Seen now in the daylight, what a wild confusion of peaks and precipices, foothills, snowfields, and glaciers it presents! How vast it all is! and how magnificent must be those mountains when one is close beneath them! But what of our travellers to the west? Here the sky-line runs from peak to peak with ridges that can rarely dip below 12,000 feet, and it is beyond hope that they can scale to such heights.

'But northward of west these lofty ridges fall again, and the ranges which stretch on beyond till they are lost in the fiery glow of the sun are lower than this monstrous pile to the west. Perhaps it is in this direction that we shall conquer the western land. It is to the west more than anywhere one realises the impossibility of understanding the conditions until our parties have been forth to face them; that there will be immense difficulties there can be little doubt. To expect to find a smooth and even road in that great chaos of hills and glaciers would be to expect the impossible, and I feel that if we ever do get beyond those mountains we shall have deserved well of our country.

'Not more than fifteen miles away in this direction one can see the long shadow marking the decayed pinnacled ice which puzzled us so much as we approached our winter quarters. One cannot trace the position and direction of its origin, but if, as we suppose, it is a discharge of the inland ice, and if it continues as we saw it at the end, it is certain to form a most formidable obstacle to our western exploration.

'Finally, from the vantage-point of Crater Hill one can now obtain an excellent bird's-eye view of our own snug winter quarters. Even from this distance the accumulation of snow which has caused us so much trouble can be

seen; the ship looks to be half-buried, and a white mantle has spread over the signs of our autumn labours and over the masses of refuse ahead of the ship. Hodgson's biological shelters show as faint shadowed spots, and numerous sharp black dots show that our people are abroad and that work is being pushed ahead.

'Over all the magnificent view the sunlight spreads with gorgeous effect after its long absence; a soft pink envelops the western ranges, a brilliant red gold covers the northern sky; to the north also each crystal of snow sparkles with reflected light. The sky shows every gradation of light and shade; little flakes of golden sunlit cloud float against the pale blue heaven, and seem to hover in the middle heights, whilst far above them a feathery white cirrus shades to grey on its unlit sides.

'Returning to the floes about one o'clock, inspired by the scenes which we had just witnessed, we informed the men that the sun could now be seen from Hut Point. To our astonishment there was little or no enthusiasm. Everyone seemed extremely pleased to hear it was there, and glad to think that it had kept its appointment so punctually; but, after all, they had seen the sun a good many times before, and in the next few months they were likely to see it a good many times again, there was no object in getting excited about it; so a few set off at a run for the point, some followed at a walk, as it seemed the right thing to do, but a good number remained on board and had their dinner. It is perhaps as well that we do not all take our pleasures in the same way or rejoice in the same sentiments, and, at any rate, it is evident that those who can so passively observe the coming day cannot have been deeply affected by the vanishing night.'

'*August* 23.—A glorious morning; have been away over the hills, clambering along Arrival ridges on the sharp angular stones heedless of the wear of my finnesko es, and sliding down the snow-slopes regardless of the

wear on other articles of clothing. This latter has been a very common practice of mine during the winter; on the smooth hard snow one can get up a capital speed without the assistance of a toboggan, but the practice has meant the frequent renewal of a patch behind.

'The air to-day was splendidly exhilarating, with a temperature of $-10°$ and a wind just sufficiently keen to make climbing a pleasure. Erebus showed a column of golden smoke rising perpendicularly for about five hundred feet and then streaming horizontally to the east; to have had this splendid beacon giving throughout our winter a continuous record of the upper air currents is luck indeed.

'What unique and glorious mountains we have about us! Nowhere else can there be such vast masses snowed to the base, and hence possibly nowhere such great altitudes above the snow-line. One wonders when the mountaineer, having conquered all the peaks of the known world, will descend on this lonely region, for here indeed lies a field where the boldness of man might have play for many a year; as parties could be left and relieved in successive seasons with practical certainty, the idea is by no means inconceivable.

'To-day one could see the islets to the north looking very black and grim; besides the group of three or four some ten miles away, there is a curious turtle-backed rock not more than three or four miles from Castle Rock, and far across the strait I could count five distinct islets bearing about W. by N. A low bank of cloud to the north shut out the sun, whose position was only marked by the intensity of the golden-red glow above: small fleecy intermediate clouds were floating about Erebus, golden or grey as they passed from light to shadow.

'The scene is so rarely beautiful that on the hill-tops one seems to breathe inspiration from the keen air, and one's thoughts are compelled to soar out of the common

groove; but as one descends to the ship they fall back on the more practical details of our life, and little remains in the memory. Here below the broad light of day has revealed not a little that is ugly. The ugliness lay concealed under the glamour of the dim mysterious twilight, but now the traces of man are all too obvious: here is a little heap of dirty rubbish, there an empty tin with a gaudy label, and everywhere the soil of traffic staining the purity of the snow. It is all a little too much like a Bank-holiday picnic.

'It is a curious fact that throughout the winter most of the officers have preferred to take their walks alone. Many, no doubt, would think that the fact was by no means curious, and that one would naturally wish to escape from companionship which he was so constantly forced to endure; and, indeed, before we sailed I constantly heard the remark, "How sick you will get of one another!" As a matter of fact, we are not at all sick of each other's company, and if it transpires that the plans of two individuals coincide as regards the day's walk, they are only too delighted to go together. The real reason for separation is that plans rarely do coincide. Nearly everyone likes to walk with an object, and no two people have precisely the same object, and if they have, it is probably not convenient to their work to leave the ship at the same hour. It has also to be remembered that when two persons are muffled up with little showing but their noses, conversation can only be carried on with difficulty, and an argument is impossible.'

'*August* 25.— . . . Yesterday we kept the Feast of the Sun, and celebrated it with an excellent dinner. Turtle soup, tinned fish, seal cutlets, and mutton, washed down with "Heidsieck, '95." The warrant officers joined us at dinner, and afterwards we had the usual small concert, and proceedings were kept up late and with the greatest hilarity. Armitage brewed punch, but after previous

experience few were rash enough to partake of it, and the few are repenting heartily to-day.

'Everywhere on board now is stir and excitement; sledges are being put together, provisions weighed out, dog-harness prepared, fur clothing overhauled, and each item of equipment carefully reconsidered. Everything is being pushed forward for a start on Monday next; the first party away, others will quickly follow, and soon, it is to be hoped, our travelling will be in full swing.'

'*August* 29.— . . . For some time past it has been amusing on entering the warm, comfortable living-quarters, to see the table strewn with garments, reels of cotton, skeins of thread, tape, thimbles, packets of needles, and every other necessary of the tailor's art, and to see gathered around the table our whole company plying their needles as though they were being sweated by some iron-handed taskmaster. Indeed, I am not sure that this is not the case: if we consider "King Frost" as a taskmaster, he is certainly an exacting one. This sort of thing is bound to go on until we actually start on our journeys, because no one is ever quite satisfied with what he has made, and when a garment is completed there is always some suggested alteration that promises to be a slight improvement; and after the spring journeys, when we have had more experience, the probability is that nearly everything will be altered again. However, it is very cheering to see so much enthusiasm displayed, and it augurs well for our work that everyone should be taking it so seriously, and should be so evidently bent on making it a success.

'So our only sewing-machine clatters away all day long, whilst bent fingers are stitching busily, and the whole ship is alive with the bustle of our active preparations. I have issued orders for sledging to commence next week, and for the gear to be ready for packing on Monday.'

'*Monday, September* 1.— . . . All will be ready for a start

to-morrow. The wind has sprung up again, but it is comparatively mild, and we are packing the sledges. To-morrow at this hour I hope we shall be spinning along to the north with the dogs, to test our arrangements, the climatic conditions, and the discipline of the animals; whilst Armitage and Barne, with a party of ten men, go forth on a similar errand as well as to bring back the depot which we established last year under such uncomfortable conditions. From this commencement we shall work up to our more ambitious projects.'

So now the long winter, with its darkness and forced inactivity, was at an end. Although our faces looked pale and white in the glare of the returning day, beneath the pallor lay every evidence of unimpaired vitality; and believing ourselves to be in the perfection of health, as we were of spirits, all thoughts turned to the coming season and to prospects which could look nothing but bright and hopeful.

CHAPTER X

HISTORY AND DEVELOPMENT OF SLEDGE TRAVELLING

History of Polar Sledge Travelling—Early English Sledge Travellers—Ross—McClintock—Peary—Nansen—Visit to Christiania—Difficulties in Selecting Articles of Equipment—Comparison of Sledging Conditions in the North and South Polar Regions—Objects of the Sledge Traveller—Description of our Equipment—The Sledge—The Tent—The Sleeping-bag—Sledging-food—Calculation of Allowances—Packing—Cooking-apparatus—Cooking-lamp—Permanent weights of a Sledge Party—Spare Clothing—Medical Bag—Details Concerning Clothing and General Equipment.

> Much more in this great work should we survey
> The plot of situation, and its model,
> Question surveyors, know our estate,
> How able such a work to undertake.—SHAKESPEARE.

IT may be fairly claimed that polar sledging is an English production; it is the direct outcome of that feverish energy in exploration which has distinguished our race for so many centuries and has led them to the performance of such glorious pioneer work within the Arctic Circle. To give my readers some idea of the history of sledge travelling, I cannot do better than quote the words of one who had perhaps the largest share in its making, and who gave more care and attention to the subject than has anyone before or since. The following words were written by Sir Leopold McClintock

Ship at the End of the Winter.

more than thirty years ago, and give a good idea of the conditions under which this mode of travelling was evolved, the objects it sought to accomplish, and the state of perfection to which it had then been brought:

'In early Arctic voyaging the ship alone was relied upon for penetrating into unknown seas; it was not until the second and third voyages of Parry and the second voyage of Sir John Ross—that is, between 1821 and 1834—that sledging was commenced and a number of short journeys were made, mainly by the assistance of the Esquimaux, whose methods were closely observed and more or less imitated.

'But our seamen had not yet familiarised themselves with the idea that it was quite possible for well-equipped Europeans not only to exist, but to travel in an Arctic climate, as well as the Esquimaux themselves; and it was not until the Franklin Search Expeditions were sent out, between 1848 and 1854, that men seriously reflected upon the possibility of any extensive exploration on foot; and no more powerful incentive could have been imagined to rouse the utmost energies of the searchers than the protracted absence of the missing expedition.

'The endurance of the hardiest was called forth, and the talent of invention evoked and stimulated, until at length a system of sledging was elaborated such as I will now proceed to describe.

'. . . The late Sir James Ross, who had served with very great credit in all the six voyages of Parry and John Ross from 1818 to 1834, formed the connecting link between them and the searching expeditions which commenced in 1848, and the first of which he commanded. He was acquainted with the flat sledges of the Hudson Bay Territory, which alone can be used in deep soft snow, gliding as they do over its surface; he was also acquainted with the Greenland dog sledge, with its high narrow runners shod with ivory or bone, and which cuts down through

the usually thin layer of snow and runs upon the ice beneath; he was familiar with the various modifications of these typical forms which had been used in the Arctic expeditions of Parry and John Ross.

'He had moreover made several journeys with the natives of Boothia Felix, culminating in his discovery of the Magnetic Pole, and on one of these journeys he was absent from his ship for the *then* unprecedented period of twenty-nine days. It was under his directions that our sledges and tents were made in 1848; and these designs, with comparatively slight modifications, have continued in favour in all subsequent expeditions.

'The tent requires little description. It is a pent-roof about seven feet high along the ridge, supported on boarding pikes or poles crossed at each end, and covering an oblong space sufficient to enclose the party when closely packed together; its duty is merely to afford shelter from the wind and snowdrift. . . . The sledge is a more important article of equipment. That which our experience has proved to be the most suitable is a large runner sledge; the runners are rather broad—that is, three inches—and they stand high, carrying the lading about a foot above the ice. An average sledge is three feet wide and ten feet long, and is drawn by seven men. It is constructed with only just so much strength as is absolutely necessary, since every pound of weight saved in wood and iron enables so much more provisions to be carried. All our sledges have been drawn by the seamen, and the labour of doing so is most excessive. The first sledge expedition in the search for Franklin was led by Sir James Ross in person. By very great efforts a distance out and home of 500 statute miles was accomplished in forty days; but out of the twelve picked men by whom the two sledges were drawn five were completely knocked up, and every man required a considerable time under medical care to recruit his strength after

this lengthened period of intense labour, constant exposure, and insufficient food.

'It is necessary to apprehend clearly the nature of the surface over which our sledges had to travel. People unacquainted with the subject commonly fall into one or the other extreme, and suppose that we either skate over glassy ice or walk on snow-shoes over snow of any conceivable depth. Salt-water ice is not so smooth as to be slippery; to skate upon it is very possible, though very fatiguing. But hardly is the sea frozen over when the snow falls and remains upon it all the winter. When it first falls the snow is soft and perhaps a foot or fifteen inches deep; but it is blown about by every wind until, having become like the finest sand, and hardened under a severe temperature, it consolidates into a covering of a few inches in depth and becomes so compact that the sledge-runner does not sink more than an inch or so. . . . This expanse of snow is rarely smooth; its surface is broken into ridges or furrows by the strong winds. These ridges are the *sastrugi* of Admiral Wrangell; and although the inequalities are seldom more than a foot high, they add greatly to the labour of travelling, especially when obliged to cross them at right angles. . . .

'. . . Having accompanied Sir James Ross on his sledge journey in 1849, I was entrusted with the preparations for sledge-travelling in the second and third search expeditions under Austin and Belcher; and this method now became recognised as an important feature of these voyages.

'The utmost attention was devoted to the travelling equipments and the methods adopted by Wrangell and other distinguished Arctic travellers; and the spring parties of the second expedition set out in 1851 on April 15, instead of May 15 as in 1849, and sledges carrying forty days' provisions were dragged with less labour than thirty days' rations had previously occasioned.

Moreover, the allowance was a more liberal one. The result was a corresponding increase of work done—one party remaining absent for eighty days and making a journey of 900 miles. But in 1853 and 1854 the sledge parties of the third searching expedition did still better service—one party accomplished about 1,400 miles in 105 days. Another party, having several depots along its line of route and favourable circumstances generally, travelled nearly 1,350 miles in seventy days.'

From the above it will be clearly seen that to the English explorers of the early nineteenth century belongs the honour of being the first to discover that, again to quote Sir Leopold, 'the ice which arrests the progress of the ship forms the highway for the sledge'; they were the first civilised beings to use that highway, and on it they accomplished work which has remained, and will probably remain, unsurpassed. Of his own share in this development Sir Leopold speaks most modestly, but a comparison of the periods of absence and the distances covered by the parties of the 1853 expedition with similar records in 1849 are sufficient to show how great it was, more especially when it is known that it was he himself who conducted the longest journey of the later expedition.

To realise the great revolution which had been effected in Arctic exploration, it has but to be considered that in 1820 the fact of an explorer venturing beyond his ice-bound ship had barely been considered, whereas little more than thirty years later it could be written of these far Northern regions: 'It is now a comparatively easy matter to start with six or eight men and six or seven weeks' provisions, and to travel some 600 miles across snowy wastes and frozen seas from which no sustenance can be obtained.'

Although these sledging records of half a century ago have not been surpassed, it would be incorrect to say

that there has been no improvement in sledging methods; with the march of the times and the advance of mechanical skill many details have been improved, whilst the comfort of the sledge-traveller has been increased and his hardships mitigated; but that the fundamental principles have remained unaltered is sufficiently proved by the figures.

Since the high-tide mark of 1853 England has not maintained her reputation in the sledging world; one effort of importance alone has been made—when in 1875 the 'Alert' and 'Discovery' were sent forth. The sledging outfit of this expedition was again arranged by Sir Leopold McClintock, but the margins of strength and safety were rather enlarged, so that in many respects the equipment had retrograded. In spite of this, long journeys were made in very adverse circumstances; and had the expedition been able to continue its work for more than a single year, improvements in the outfit would doubtless have been tried and further advancements suggested. In the last years of the century the Jackson-Harmsworth expedition spent three winters in Franz-Josef Land and carried out several sledge expeditions with dogs and ponies; but here, again, the effort was not sufficiently sustained to add greatly to our knowledge.

Since 1853 whatever improvement has been made in sledging methods has been developed abroad, and it is abroad therefore that the modern traveller must look for all that is latest and best in this respect. But here also he is met by a want of continuity and system; and whilst he pauses to admire the splendid efforts of individual travellers he cannot but deplore the absence of a more systematic correlation of their experiences, enabling each to benefit more fully by the difficulties which his predecessor conquered. Notwithstanding this drawback, however, there is much to be learnt from these

experiences; the inquirer will at least have embarked on a history of absorbing interest, and he cannot but emerge a wiser man if he follows it through the wild and sometimes tragic expeditions of the latter half of the nineteenth century and studies the historic journeys of such great explorers as Peary and Fridtjof Nansen.

The sledge equipment which we took to the South was the result of much consultation; in arranging it, I had to depend largely on the experience of others, and especially on the experience of one, Mr. Armitage, whose interests were identified with the expedition. From the commencement of that busy year of preparation which preceded the departure of the expedition, when on my own inexperienced shoulders alone rested the responsibility of every department of an undertaking of such considerable magnitude, I realised the primary importance of an efficient sledging outfit, and I strove to glean from every source such information as should serve to see us properly provided in this respect.

The difficulties were great. In England a quarter of a century had elapsed since sledging expeditions of magnitude had been accomplished, and during that time not a single sledge, and very few portions of a sledge equipment, had been made in this country. The popular accounts of former expeditions were not written with a view to supply the minute detail that was required, and no memory could be expected to retain these details after the lapse of such a time; the art was lost. But, fortunately, the genius of Nansen had transferred it or built up a new art in Norway. Having modernised the methods of the older English sledge-travellers, he had gathered about him a small body of tradesmen cognisant of his ideas and capable of carrying them out. Christiania had become, so to speak, the centre of the sledging industry, and within easy reach of the city lived and worked the man who had made it so, always ready to give advice

and assistance to all who needed it, and always ready to help those who, like myself, were embarking on the field of exploration in which he had played so eminent a part.

In the autumn of 1900 I visited Christiania, and in Nansen's company interviewed the various tradesmen who worked under his superintendence, whilst obtaining many a practical hint from the explorer himself. But now, as always, Nansen was an extremely busy man, and, kind and considerate as he was, it was impossible not to realise that one was robbing him of hours which he could ill afford to spare.

Moreover, my own work was of such a nature as to necessitate haste; with so much to be done in England delay was not permissible, and much as I should have liked to linger and increase my knowledge in this province, I was forced to curtail my visit to the shortest possible limits. However, I had learnt enough to give me a practical idea of the basis on which our equipment should be collected. It seemed evident that we should have to purchase in Norway some important part of our outfit, but I saw no reason why the main portion should not be made under our own superintendence in England, provided we could supply patterns or full instructions to the makers. Sledges, ski, and furs could be made and supplied from Norway at a price and of a quality which we could not hope to equal in England, even had we been prepared to issue the fullest instructions and specifications, which we were not. On the other hand, tents, clothing, cooking-apparatus, and other details could be obtained in London if the necessary superintendence were available.

Having some ideas and notes as to what our requirements were, the question now in my mind was how these ideas should be put into effect; with such a vast amount of work connected with other departments, I could not possibly devote the necessary time to these details, and

even had I attempted to do so I should have been handicapped at every turn by my want of practical experience. I was for some time in this dilemma before Sir Clements Markham forwarded me a letter written by Mr. Armitage, who was at that time serving in the P. and O. service in the Far East. Armitage, as I knew, had served in the Jackson-Harmsworth Expedition, but it was not until I read this letter that I realised how invaluable such an experience might be; the letter was written with the intention of suggesting the lines on which our sledging outfit should be prepared, and I saw at once that it contained the ideas at which I had been so ineffectually attempting to grasp. Armitage met me on his return to England, and agreed to serve as second in command of the expedition, provided the permission of his directors could be obtained. This was granted, and within the month, after numerous consultations, Armitage was in full direction of that important part of our preparation, the sledging outfit. Time was all too short for the excessive care and attention that were needed, but, thanks to untiring efforts, we had collected all that was necessary in this respect before the expedition left the London Docks in July 1901.

In describing the various articles of this equipment, I shall explain in some detail their origin, and endeavour to point out in what respects they suited our purpose, and in what respects they failed. It must be remembered that in making long sledge journeys in the South we had no previous experience to go on except that which had been gained in the North; we were forced to assume that Southern conditions were more or less similar to those of the North, and in so far as they proved different our sledging outfit ran the risk of failure.

We found, in fact, that in many respects our sledging conditions differed from those in the North, and it is just to consider all our sledge journeys as pioneer efforts.

It is perhaps as well to indicate these differences here; they are essentially climatic and geographical.

In regard to climate, the conditions in the South are more severe than those in the North; the spring temperatures are lower, and the summer temperatures far lower. The early spring travellers in the North have rarely recorded a temperature below −50°, whereas with our early parties the thermometer frequently fell below −60°, and at its lowest stood at −68°; in the Arctic summer travellers have experienced temperatures of +40° and even +50°, whilst in the height of our Southern summer the thermometer rarely rose above freezing-point, even on the great snow-plains adjacent to the sea-level; and when we were forced to explore at great altitudes, we were fortunate if it showed higher than −10° at this season.

The effect of these generally low temperatures was naturally to increase the hardships to which the sledge-travellers were exposed, and of which so much has been written, while it is doubtful whether we could have so well withstood this greater intensity of cold had we not been possessed of those improvements to the sledging outfit which have been added in the years that have elapsed since the great English journeys of 1850. But the low summer temperature has one advantage, although we were not fated to gain greatly by it, in that the snowy surface of the sea-ice never gets into that sodden, slushy condition which obtains in the latter part of the Northern summer, and which prevents sledging operations being undertaken after the month of June in the Arctic Regions. Except in a few places where dust or grit has been blown on to it, the surface of the Southern sea-ice remains hard throughout the summer; and as there are many places where it does not break up until the latter part of February, it is quite possible to conceive sledging being carried on over its surface

until that month, which corresponds with the Northern August.

A circumstance, however, that is far more objectionable to the Southern traveller than the extremity of temperature is the frequency of wind. It is perhaps too broad a generalisation to say that Arctic journeys have usually been made under fine-weather conditions, but few, if any, Arctic travellers have been subjected to the distressing frequency of blizzards and strong winds that added so much to our discomfort in the South. Here again, therefore, the Southern traveller is at a disadvantage from a climatic point of view, and the effect is to increase his discomforts and reduce the distance he is able to march, for it is only on the very rare occasions on which a sail may be used that wind brings any compensating advantage. In general, therefore, from a climatic point of view, the South is at a considerable disadvantage as compared with the North in sledge-travelling.

The geographical difference between the work of the Northern and the Southern sledge-traveller is as great as the climatic, if not greater. With the exception of Nansen's and Peary's journeys into the interior of Greenland, the sledge journeys of the North have almost invariably been performed over level if not smooth sea-ice, and it is especially to be remembered that those record journeys to which Sir Leopold McClintock refers were made amongst the frozen channels of an archipelago. If sea-ice is much broken up and hummocked, it may constitute one of the worst travelling surfaces, but if it is smooth it is undoubtedly the best that exists. In very general terms, therefore, with the exceptions I have mentioned, the travelling of the North has been carried on over a comparatively good surface, and those travellers who constitute the exception in having ventured on the inland surfaces have made it abundantly clear that the difficulties are far more formidable than are found

on anything but the most hummocked sea-ice. Turning now to the South, it will be seen that everywhere the explorer's ship is brought up by solid land or by some mighty wall resembling that of the Great Ice Barrier; to pass beyond his ship, therefore, the explorer must either travel over land or over great and ancient snow-fields which possess a similar surface. Judging from our present knowledge of the Antarctic Regions, it is doubtful whether extensive journeys will ever be made over the sea-ice.

We have, therefore, this great geographical difference between the North and the South: the greater part of Northern travelling has been and will be done on sea-ice, but the greater part of Southern travelling has been and will be done over land surfaces, or what in this respect are their equivalents.

The relative merits of these surfaces, always excepting the very rough hummocked sea-ice, is a matter which has been placed beyond doubt by travellers in the North, and hence it is of interest to relate our own experience with regard to it. On travelling over the Great Barrier to the south, I was constantly impressed by recognising the difficulties of surface so graphically described by Nansen in his 'First Crossing of Greenland,' and I came to the conclusion that the conditions were very similar. But I was still more impressed by the obvious impossibility of dragging a sledge over such a surface at the rate maintained by the old English travellers on the Northern sea-ice. I was so exercised on this score that I was forced to wonder whether it might not be our own incapacity for walking that caused us to fall so far short of those old records, and the thought that the British race of explorers had deteriorated so rapidly and so completely in stamina was by no means a pleasant one. In the following year, in carrying out our exploration to the west, I made no fewer than six crossings over the

sea-ice of the strait, a distance of about forty-five statute miles, and the mystery was revealed when we found that we could cover this distance with full weights in two and a half days, while with light weights we actually got across in one and a half day, covering over thirty-six miles in a single day.

It was consoling to be free from immediate alarm in regard to our racial stamina, but a flood of light was thrown on the comparatively difficult nature of the barrier surface; we saw that the difficulties we had met in crossing it were by no means existent only in our imagination. The barrier surface varied greatly, but, taking an average condition, I doubt whether we should have approached twenty miles over it by expending an equal amount of energy to that which gave us the thirty-six miles over the sea-ice. This argues a great difference, and it is one that cannot be wholly explained. Of course the primary condition of importance on which the excellence of a surface depends is its relative hardness. The snow surface of the sea-ice, when we crossed it so rapidly, was so hard that the sledges left but a faint crack; at the same time, it was not too hard to prevent one's fur-clad foot from getting some grip at each step. On the other hand, the sledges always left a well-marked track in the barrier surface, and at each step one sank ankle-deep and sometimes even deeper. But this is by no means the only factor that governs a surface; wind, sun, temperature, and the age of the snowfall are all elements that affect it, increasing or decreasing the friction on the sledge-runners in a manner that is often inexplicable and sometimes exasperating. All such changes, however, will be dealt with in the accounts of our sledge journeys; for the present it is only necessary to point out that it is difficult to define exactly what constitutes a good or a bad sledging surface.

Besides being dependent on the climatic conditions

and on the nature of the snow over which he journeys, the sledge-traveller has to consider other obstructions which more obviously hinder his progress. On the sea-ice he may meet with those elevated fragments pressed up by the movement and distortion of the ice-sheet, which are commonly called hummocks; on sea or on land he may encounter regions where the wind has ploughed the snow into furrows, the waves between which are technically termed *sastrugi;* on the land-ice he may meet vast ridges and chasms, cracks and crevasses, mild and gentle undulations, or any other resultant of the irresistible movement of an ice-sheet. All such obstacles are very obvious deterrents, and exist both in the North and in the South, but to a different degree. Sea-ice in the South, as far as we know it, is extraordinarily free from hummocks, and such is its geographical situation that the probability is there are few places in the Antarctic Regions where the ice will be found much pressed up; while in the North hummocks have been the bane of many a sledge journey. In regard to *sastrugi*, it is probable that such a wind-swept area as the Antarctic outvies the more placid North; indeed, I doubt whether snow-waves have ever been seen before of such giant size as some which we observed abreast of our windiest gullies or on the high plateau of Victoria Land. In regard to the disturbances of the vast land ice-sheets it is difficult to institute any comparison with the North, but these formed a sufficiently solid obstruction to many of our sledging efforts.

A general comparison of the sledging conditions met with in the North and in the South cannot be said, therefore, to be in favour of the latter, and it must be conceded that the Antarctic sledge-traveller journeys under considerable relative disadvantages; he has to meet severer climatic conditions, he has to pull his sledges over heavier surfaces, and he is not likely to encounter

fewer obstacles in his path. Hence it is probable that the distances recorded by the Northern travellers will never be exceeded in the South.

I do not wish it to be inferred from what I have written that the sledge-traveller does or should go forth in order to make marching records; but whatever his objectives may be, it is obvious that they are best achieved by speed on the march; and hence where conditions are equal, speed and the distance travelled are a direct gauge of the efficiency of sledging preparations and of the spirit of those who undertake this arduous service.

From the summary, necessarily brief, of the history of the development of sledge-travelling which I have given, and the equally brief account of the physical conditions under which it is conducted, the reader will see that the object of the traveller is to journey as far as possible beyond the limit to which his ship can attain, and some idea of the problems that are encountered in pursuit of this object will have been conveyed. The weight which can be dragged by a party is limited by the draught-power they possess, but it is also dependent on the surface, the state of the sledge-runners, the manner in which the sledges are loaded, and many other details. The greater the proportion of food in this weight, the longer is the possibility of absence; but sledges must possess strength, and therefore weight; man must be sheltered and clothed, and this cannot be done without weight; and civilised man requires hot food, and must therefore drag the weight of his cooking-apparatus and fuel.

The less that is eaten by any individual, the longer the food will last; but there is a limit where economy ceases, and insufficient food produces loss of strength and reduction of marches. The longer the marches, the greater the distance covered; but staleness awaits the over-pressed marcher.

Good sledging is the nicest balance of all these conflicting elements, and it is clear that it can only be accomplished by the utmost attention to detail in preparation, the complete exclusion of all but the bare necessities of life, and, above all things, by the display of an unconquerable determination to carry it through in face of all risks, dangers, or hardships.

Perhaps the most important part of the sledge-traveller's outfit is the sledge itself. Our sledges had been made in Christiania, to comprise all those modifications and improvements which had been suggested by the experience of Nansen, and on the whole it is doubtful if we could have provided ourselves with sledges more suitable to our various purposes. The main differences between these sledges and those used by older explorers were a decrease in breadth and an increase in runner surface.

Such a sledge as we used consists of two long runners, slightly rounded beneath, with a strengthening rib above, and curved up at each end. The strengthening rib is pierced with holes at intervals, into which are tenoned the uprights, short pillars of wood about four inches in length; adjacent uprights are joined by cross-bars, and the heads of the uprights on each side are connected by long thin strips of wood, which end in junction with the upturned ends of the runners. There are four, five, or six pairs of uprights and cross-bars, according to the length of the sledge.

In the numerous joints thus created only those which connect the uprights to the cross-bars are rigid, and these are strengthened by small steel stays bound to the frame with wire. It is of the utmost importance that all other joints should be flexible, in order that the sledge may have the fullest play over a rough surface, and therefore all these joints are made with lashings of either hide or tarred hemp. Hence the sledge, when put together, is by no

means a rigid structure. Lifted by one corner, it can be distinctly seen to sag in the centre; and as it is dragged over a rough snow surface it is rarely possible to see any portion of the runner which is not in contact with the snow—in fact, it is very fascinating to watch a heavily laden sledge winding its way over rough ground in this snake-like manner. The load being distributed over a great area, no part sinks too deeply.

Measured across from the centre of one runner to the centre of the other, our sledges were all, with one exception, 1 foot 5 inches. The runners themselves were $3\frac{3}{4}$ inches across, so that the sledge track from side to side measured about 1 foot $8\frac{3}{4}$ inches. In all we had twenty sledges when we began, and this allowance proved barely sufficient for our two years' work; we could, indeed, well have done with half as many again, but this was owing to much of the travelling being over extremely rough country. These sledges were of various lengths; we had two of 12 feet, six of 11 feet, nine of 9 feet, and three of 7 feet; of these the 11-foot sledges proved by far the most convenient for our work, though the 9-foot were much used. A length of 12 feet seemed to pass just beyond the limit of handiness; whereas the very short sledges were comparatively stiff, and skidded about so much on a rough surface that they were often more troublesome to pull than the heavier and longer ones.

Taking 11 feet as about the best length for this type, it will be seen that we have a comparatively long and narrow sledge at considerable variance with the old Arctic type, which was 10 feet long and 3 feet broad. The advantages gained by the longer sledge are an increased strength against racking strains and an easier motion over inequalities of surface; on the other hand, the broader type has more stability and a greater and more convenient stowage capacity. Our own sledges had to

be stowed with great care so as to bring the weight low, and even thus over rough *sastrugi* they would frequently capsize; in spite of such disadvantages, however, I am inclined to favour the longer and narrower form. The increase of runner surface which was adopted by Nansen in what he named his 'ski runners,' was a comparatively natural outcome of the new condition of surface for which he prepared on his inland journey, and as our conditions were very similar, it is a fortunate thing that we possessed broad runners. There were many occasions on which they were not needed, and when a light narrow runner would have been all that was required; but there were others when we needed every inch of bearing surface we possessed to support the sledges on the light soft snow.

The weight of an 11-foot sledge such as I have described may be anything between 40 and 47 lbs., and this was none too light for some of our purposes where the full strength of the structure was required; but on the level barrier I think it would be possible to travel with a considerably lighter sledge. The weight which can be placed on such a sledge varies according to circumstance, but in general the full load may be said to be about 600 lbs.

These sledges are made of ash, and it is of great importance that the wood should be thoroughly well selected and seasoned. In some of our sledges the wood was not above suspicion, and caused some inconvenience. The most important part is the runner, in which the grain should be perfectly straight and even, otherwise it will splinter even when running over snow. It is surprising what a lot of wear a good wood runner will stand provided it is only taken over snow. Some of our 9-foot sledges must have travelled over 1,000 miles, and there was still plenty of wear left in the runners.

The older Northern sledges were shod with iron or steel, and Nansen covered his Greenland sledge-runners

with the same material. The drawback to this is that it is liable to rust, and in a rusty state the friction is of course much increased. In his Northern journey Nansen substituted German silver, a non-corrosive metal, for steel, and reported the result as satisfactory; in consequence the runners of all our sledges were covered with this metal, which added considerably to their weight, though that quoted for the 11-foot sledge includes this item. This shoeing gives rise to a difficulty, since there are certain conditions of surface when German silver offers great friction, whereas it is impossible to strip the runners to meet these conditions and then to replace the metal. To get over this difficulty Nansen devised thin under-runners of wood with light steel attachments, thus providing for the condition when a wooden surface for the runner would be desirable, but again adding to the weights carried. As far as our experience went, both the German-silver shoeing and the wood under-runner proved unsatisfactory; in nine cases out of ten on the snow surfaces over which we travelled, wood runners offered less resistance than metal, and though the idea of the under-runner is theoretically good, we found that practically the thing was too flimsy; the snow tended to pack above it, and it was liable to become loose and distorted. Moreover, it introduced a complication where simplicity should be the first consideration. As far as all our journeys made over the flat on snow surfaces were concerned, the plain wood runner of the sledge itself, without any covering, would have been amply sufficient, and in fact, as I have pointed out, well-seasoned wood would stand far more wear than could well be given it in the course of a single expedition.

But many of our journeys lay over hard rough ice or places where sand and grit had been blown over the snow and where an unprotected wood runner would soon be torn to shreds. It was here that the German silver

should have served us, and to some extent it did; but in the main we found it altogether too soft—grit was liable to score it deeply, and the metal once pierced, the runner gave an infinity of trouble.

The difficulties we were put to on account of our sledges and sledge-runners will be mentioned in due course, but it is as well to lay down here, for the guidance of future travellers in these regions, such recommendations as arise out of our experience.

It may be safely said that the 11-foot ski-runner sledge is a good type for general purposes in the Antarctic Regions, whether it is to be hauled by men or dogs. It would be a good plan to have sledges made of different weights to suit special circumstances. Under ordinary conditions such sledges may be allowed to run on their wood runners, but if it is desired to ascend glaciers or travel over rough ice, a steel-protected runner is necessary. As a general rule, such a protection would only be required for a limited part of the journey, and I do not think it would be difficult to devise one which could be temporarily secured by clamps and detached when no longer of use. The importance of selecting the wood of which the sledges are made cannot be too strongly urged. Though ash has been mostly used, I understand the American hickory is also an excellently tough wood for the purpose. Sledge-runners have also been made of elm and maple, either of which offers little friction to the snow.

Before leaving the subject of sledges it is well to mention the necessity of providing strong heavy ones for the ordinary work about headquarters, for the travelling sledges would soon be knocked to pieces at this. Three or four heavy rough sledges with narrow iron-bound runners did all our heavy work about the ship during her stay in the ice.

In point of numbers the 'Discovery's' crew was far behind the old Northern expeditions; it was this fact

that first decided us, in arranging a sledge equipment for a condition where men, and not dogs, would do most of the haulage, to divide our parties into the smallest workable units. The old Northern plan had allowed for parties of twelve, or at the least eight, who were in all respects self-contained, but, having a common tent and cooking arrangements, could not be subdivided. Without necessarily limiting the number of men in our parties, the system we aimed at was to divide them into units of three, which should be self-contained, so that whenever it was advisable a party could be split up into threes, or three could be detached from it, or, again, three people could leave the ship without carrying more than was necessary for their requirements. It is obvious that with such a system each unit of three must have its own tent, its own sleeping-bag, cooker, and so on; and herein lies a disadvantage, as economy of material and weight can be better carried out with a large unit than with a small one. It has also to be remembered that the risk of accident is increased in a small party by the diminishing of its capacity for mutual assistance. But with our small crew it was clearly advisable that we should be able to break up into small numbers, and in the course of events we frequently did so. It will be understood, therefore, why each article which I am about to describe was designed to satisfy the requirements of three men, and this fact should be remembered in comparing any weights I may quote with those carried by former expeditions.

The object of a tent is to provide shelter from the wind and drifting snow. Those we used were bell-shaped. Some were made of the lightest green Willesden canvas, and others of thin gaberdine; we rather preferred the former, as they let in more light, and the green tint was especially grateful to the eye.

Each tent was spread on five bamboo poles; the poles were seven feet in length, and united at the top, and when

spread the tent was about five feet six inches in height and about six feet in diameter on the floor. It was kept more or less tight down on the poles by digging out and piling blocks of snow on its vallance, or skirting edge—a device which also effectually prevented the wind and snowdrift from getting in beneath it. The entrance was a hole about two and a half feet in diameter, and the funnel-shaped door was sewn around its edge, so fitted that the material of which it was composed could be gathered up into a bunch and tied from the inside. This bunch once tied up, the entrance was practically drift-proof. There was one other hole in the tent close to the top which was named the ventilator, but would have been more correctly called the chimney, as it was rarely opened except to allow the steam of the cooking to pass away, instead of being condensed and frozen on the sides of the tent. This orifice was closed in a similar manner to the entrance.

On the floor inside the tent was spread a stout square of waterproof canvas which prevented the sleeping-bag or the occupants from coming into immediate contact with the snow surface. This floorcloth spread on bamboos likewise made an excellent sail, but could be used in this capacity only when the wind was abaft the beam.

Such a tent, with poles and floorcloth complete, weighed about 30 lbs., and I do not think it would be safe to use a tent of less weight in the Antarctic Regions owing to the heavy strains which are brought on it by the frequent gales. In this respect our tents deserve a high meed of praise. When we first travelled with them in windy weather, and in their shelter were forced to listen to the thunderous flapping of the canvas as gust after gust swept across the plain, we were not a little alarmed for their safety and our own ; it seemed impossible that a thin shred of canvas could withstand attacks of such violence. We went so far as to fit extra guys on the

principle of what is known to the sailor as a *euphroe*, to assist in preserving the stability of the erection, and when it was possible we built snow walls as a further protection against the extreme force of the wind. But with greater experience we gained more confidence in our tents, till finally we realised that if they were properly secured with snow it would take little less than a hurricane to uproot them. Before the second year, the constant flapping had worn the canvas very thin and threadbare, and as far as appearances went in the second season they presented the most dilapidated aspect from the numerous patches of various colours which we had been forced to insert in the weak places. It was when in this condition they still offered a bold front to the wind, and saved us from the rigours of many a storm, that we realised their excellent design and complete suitability for Antarctic purposes. A tent made to contain more persons would naturally economise material and save weight, but I have already explained why we chose ours of such small dimensions. Silk is a possible substitute for the heavier material we employed, but, strong as it is, I doubt whether it would have equal wearing qualities, and should it fail in this respect one might pay dearly for the saving in weight.

Experience teaches that the comfort of a tent depends largely on banishing loose snow and snowdrift. People learn to take the most extraordinary precautions in brushing their clothes and their boots before entering, and in having the floorcloth well swept within—precautions which are a great aid in keeping the equipment free from ice, and thus decreasing the weights carried as well as the discomforts of the journey. But this care is largely a question of personality; and just as in a house it is generally some particular person who deposits mud on the carpets, so in a tent it is generally some particular person who seems incurably desirous of adding to the snow within. The qualities of a sledging companion, however,

are compounded of too many elements for him to be condemned on such a trait alone, and in that small community of three, where nothing can be hidden, and good and bad must alike be judged, it is not improbable that this very carelessness may serve to make the delinquent the more beloved.

Though it may not appear so on the surface, the sleeping-bag is really a more important article of equipment than the tent. In the bitter blast of an Antarctic storm it would be possible to exist without a tent, but it is doubtful if one could remain alive without the shelter of 'the bag,' or some additional clothing which corresponded to it. All our fur clothing had been purchased in Norway: we had some suits and mits made of wolf-skin, but the greater proportion of the furs were of reindeer-skin. The pelt of the reindeer does not possess a fur in the sense which might be understood by ladies who are accustomed to dress themselves in the soft expensive productions of a London furrier; the reindeer possesses only coarse hair, but the hair is closer and thicker than on any other animal, and therefore, for reasons which are rather too technical to be given here, the skin is better suited for the polar traveller than any other. We had never contemplated dressing in furs for our journeys, but the many troubles to which sleeping-bags give rise had induced us to consider the possibility of replacing them by fur suits which would be adopted for night wear only. Our autumn journeys had very soon shown us the error of our ways. The sleeping-suits soon got into such a hard, stiff state that it was almost impossible to get into them, and, once in, one was practically incapable of motion; in fact, we thought the discomfort of a night where three persons thus clad were striving for rest in a small tent would be difficult to equal.

When the winter set in, therefore, our men were soon busy converting the reindeer suits into sleeping-bags;

and as besides the suits we had a quantity of unsewn skins, there was plenty of material for the change.

As can be imagined, the actual work of turning out the bags, after a suitable design had been fixed upon, gave little trouble to men who were accustomed to the use of sail needles; but this fact serves to indicate a point which I hope to make abundantly clear—namely, that there is no class of men so eminently adapted by training to cope with the troubles and trials of sledging life as sailors.

In this manner a few single sleeping-bags were made, but the greater number were designed as 'three-man bags,' so that all the occupants of a tent could sleep in the same bed. The single bag had certain advantages: in particular, when the temperature rose it was pleasant to have shelter which was all one's own, and for officers the single bag served as a receptacle in which they could keep their diaries and note-books; but from a point of view of weight the advantage lay all on the side of the 'three-man bag,' a consideration so important that eventually everyone used these bags on the longer journeys.

The 'three-man bag' was made with the fur inside and with an overlap at the head and at the sides, in addition to a large flap which could be drawn up over the occupants when they had settled themselves within. This flap completely covered the entrance, and could be secured to the top and sides with beckets and toggles.

In the springtime these toggles were all rigidly secured, and every effort was made to stop up the gaps which might be left between the flap and the bag; one felt and found that it was impossible to be too tightly sealed up, and many a pipe smoked under these conditions showed that the icy draughts from without could not be wholly banished. The warmest position in the bag was naturally the middle, but it was not always preferred. As an offset for his increased comfort it was the duty of the centre occupant to toggle up the bag—a task which, with bare

cold fingers, was by no means pleasant, and generally occupied a considerable time.

Our three-man sleeping-bags weighed a little over 40 lbs. on starting from the ship; on their return from the spring journeys they were often found to be more than twice that weight from the accumulation of ice which they carried.

It would be possible to make such bags lighter by using the skins of younger animals; and here, again, it is of importance that great care should be taken in choosing the skins intended for use in an expedition. In our case the haste of our preparations prevented sufficient care being taken, and in consequence we found a good number of our skins unsatisfactory. Nearly all had come from older animals, on which, whilst the fur is heavier, it is not necessarily warmer. To be stowed on the sledge each day the sleeping-bag had to be doubled over, rolled up, and secured with rope—no easy job when it was stiff and hard and the weather was cold. As may be imagined, also, when snow was drifting in the air very great caution was needed to prevent it from getting inside the bag.

The most difficult matter to arrange on a sledge-journey, and the matter on which there is likely to be the greatest difference of opinion and the most controversy, is the food.

The issue is clear enough: one desires to provide a man each day with just sufficient food to keep up his strength, and not an ounce beyond. It is certainly suggestive of a normally overfed condition in civilised mankind that when it is reduced to this allowance it is conscious of much inconvenience from the pangs of hunger. The great difficulty for the sledge organiser is to arrive at this happy mean, more especially as it can be regulated by no food allowance given in other parts of the world which enjoy a less rigorous climate. The sledge-traveller seems to need not only a special allowance, but also a specially

proportioned allowance. If one really goes into this matter with some thoroughness, as I had the leisure to do, one is involved in a bewildering array of facts and figures which it would be hopeless to attempt to display with clearness to the reader; but there are a few facts which may be quoted with advantage, not only on the chance of their being of interest, but because they show the exceptional requirements of the sledge-traveller. And it must be remembered that, apart from all theoretical conceptions in fixing the ultimate allowance for our travellers, I had the benefit of a great deal of practical experience, and can therefore speak with some knowledge of the subject.

The following is a physiological estimate of the proportionate energy expended by an average man in a day who does eight hours of hard mechanical labour:

Heart action and respiration expend	62,100	kilogramme	metres
Bodily heat produced expends . .	620,000	,,	,,
Mechanical work for eight hours . .	125,000	,,	,,
Total	807,100	,,	,,

Assuming these figures to be even approximately correct, the absurd disproportion of the energy expended on work is noticeable, and hence man cannot be treated like a machine and fed in proportion to the amount of work he does. It has a very practical bearing on our subject, since it has been remarked by even experienced sledge-travellers that if a party are forced to remain in their tents for a day they ought to go on half-food allowance, and I have seen some of our own officers rather chagrined to find that appetites remained almost as keen during a period of forced inaction as when a long day's work was being performed.

The above, therefore, shows that food cannot be materially reduced whilst parties remain in camp, and that the sooner they are on the march again the better it is for

the distance they will eventually be able to travel. The figures which I have quoted also tend to show why it is that a man requires more food in a polar climate than in a temperate one, for it is evident that the expenditure on bodily heat will be larger.

During our second year in the South I very carefully calculated the food which was provided for my own party, but I allowed other officers to modify this allowance according to their own ideas. I then calculated the result of my own and Barne's ideas to rank in the following table. It is now pretty generally known that our ordinary food can be placed under three headings—the proteids, or nitrogenous food, such as is mainly supplied by meats; the fats; and the carbohydrates, or farinaceous foods. It is known also that man ordinarily assimilates a given proportion of these various natures of food. I do not vouch for the exact accuracy of this table, more especially as I find authorities differ much as to actual requirements in this respect; the table purports to give the number of ounces of water-free food required under the different headings, and I have neglected salts.

	Amount required for Man in full Work according to different Authorities.			Prisoner on Hard Labour.	Army on War Footing.	My own Allowance.	Barne's Allowance.
Proteid . . .	4.5	4.8	4.4	4.0	4.8	8.6	7.9
Fats	3.0	4.1	2.0	1.5	1.0	4.4	4.2
Carbohydrates .	14.2	12.4	17.6	19.0	18.8	15.6	17.0
Total . .	21.7	21.3	24.0	24.5	24.6	28.6	29.1

In my first year of sledging work I went south with something considerably under the allowance given above, when my party suffered much from hunger and grew decidedly weaker; in the second year, with the allowance shown, our strength was fairly well maintained, but there

was still no doubt about our hunger. There can be little question, therefore, that polar sledging ranks an easy first as a hunger-producing employment, and inferentially from that fact one can draw some conclusion as to the arduous nature of the work.

But from the foregoing I do not wish it to be thought that we were able to maintain our daily life on an allowance of twenty-nine ounces of food per man. This figure represents the *water-free* weight. Whereas absolute freedom from water can only be calculated, it is never achieved; and herein lies one of the greatest difficulties that faces the sledge-traveller, since it is obvious that the water is a dead and useless addition to his weights. Some idea of the difficulty can be gathered from the statement that ordinary cooked meat contains no less than 54 per cent. of moisture. Hence, to the sledger, to reduce the water in his food is of as much importance as to curb his appetite. It is therefore of interest to quote the actual nature and weight of food carried on the occasions which I have taken for examples.

	Ounces per Day per Man.	
	Self.	Barne.
Biscuit	12.0	14.5
Oatmeal	1.5	1.5
Pemmican	7.6	7.6
Red Ration	1.1	1.1
Plasmon	2.0	1.5
Pea Flour	1.5	0.7
Cheese	2.0	1.5
Chocolate	1.1	1.1
Cocoa	0.7	0.7
Sugar	3.8	3.8
	33.3	34.0

One or two articles in this list need explanation. Pemmican was, I believe, the name given in the Hudson Bay Territory to a compound of dry buffalo meat and lard. It was transferred to the dried beef and lard carried by the Northern sledgers, and in that sense it is still retained. The best of our pemmican came from Messrs. Beauvais, of Copenhagen, and contained 50 per cent. of lard and, what was not so pleasing, 20 per cent. of moisture; later on we received from the 'Morning' some good pemmican made by the Bovril Company. The red ration was a nondescript compound of bacon and pea-flour. I am not very sure as to its food value, and it was retained because it was starchy enough to thicken our nightly soup and make it a mixture which, as the sailors said, 'stuck to your ribs.'

The remaining articles need no comment, but I should not forget to add that the following were also carried, though for purposes of comparison I have omitted them from the first list. Each tent was allowed per week:

0.75 lb. of tea.
0.5 lb. of onion powder.
0.25 lb. of pepper.
0.4 lb. of salt.

The totals compared with the figures given before show the amount of water which was unavoidably present, and without going into details I can assure the reader that when one obtains over twenty-nine ounces of food value out of thirty-four ounces of weight carried, one can congratulate oneself on having one's food in an exceedingly concentrated form.

Including the smaller matters which I have mentioned, this total would be brought up to thirty-five and a half ounces as the daily allowance per man. It is interesting to compare this with the allowance given in Northern

expeditions. Greeley allowed thirty-six ounces; McClintock, forty-two ounces; Nares, forty ounces; whereas Parry, in the early days, allowed only twenty-two ounces. The journeys of the latter were not of great length, but one can imagine how famished his party must have been.

The trouble taken in apportioning the different natures of food has an extremely practical bearing. The object aimed at is that, whilst the traveller develops a craving for food, it should not be for any particular form of food. I have heard it said by members of the older expeditions, 'The thing we craved for was sugar,' or 'The thing we craved for was fat,' and without doubt this argues that the party would have been better provided had they carried a greater proportion of these articles and less of something else.

In this connection I may point out that Barne's allowance contained more biscuit than mine, and I am not sure that he was not right, as our biscuit was certainly on the short side, and we had a distinct craving for more. On the whole, however, our parties went well in this respect. Our people on getting back to the ship wanted food and plenty of it, but did not especially demand it in any particular form.

From the above list it will be seen that our variety of food was not a very large one. Nansen seems to have been of opinion that variety was of great importance, but in this I cannot agree. During our long absences our food was pretty much the same day after day, and though we sighed for greater quantity we were never particularly desirous of changing the quality. The great drawback to a large variety is the complication which is introduced into the packing arrangements; that these should be as simple as possible with a party of men is of the greatest importance. Our biscuit was packed on the sledges in boxes or in canvas tanks specially made on board for the purpose, but although the boxes were of

the lightest *Venesta* packing material, the additional weight involved by either tank or box was considerable. The packing of biscuit is especially difficult, because if packed loosely it will grind itself into fine powder with the movement of the sledge, so that probably much will be lost.

All the remaining provisions were carefully weighed out into amounts which constituted the allowance for three men for one week; this amount was placed in a small light bag, and then all the small bags were placed in a canvas tank on the sledge.

In addition to this, each tent party of three men possessed a ready-use bag containing all the small bags allowed for the week. It will be seen that this was an extremely simple arrangement; all the trouble and care had been taken on board the ship, and when once away the arrangements went like clockwork. Each member of the group of three living together in a tent would take it in turn to be cook for the week. On the stated day he would go to the provision tank and take out his allowance of small bags; these he would place in the ready-use bag, which was always kept handy on the sledge. When camping-time came and the tent was up, the cook would get inside, with his provision bag and cooking-apparatus, and with everything under his hand he was able to prepare supper in the shortest possible space of time. Of course the cook was responsible for the weekly allowance lasting out its proper time; if it ran short before, the inmates of the tent had to go hungry, and this made the cook unpopular.

I have said there was little variety in our provisions, but a good cook had some chance of showing his abilities. Even in such a *ménage* he could vary the ingredients of his *hoosh* each night, provided he did not outrun the constable, and a very wily cook would save a bit here and there during his term of office so as to end it up with one

really thick 'stick to the ribs' *hoosh,* which kept his memory green for several days.

The weekly allowance of food for a tent I called a provision unit, and I find I had to allow at least 6 lbs. for the packing of each unit.

The habit of heating his food is about the only one possessed by the sledge-traveller which can be said to go beyond the bare necessity of life. Theoretically I believe the food would be as nourishing and sustaining were it swallowed cold; it would only lose its immediate stimulating effect. Hence to some extent fuel is a luxury, but even from this point of view not entirely, for it would always be necessary to carry some fuel and some vessel in order to obtain water for drinking. As regards the heating of food, I can only say that I should prefer to be absent from a party who had decided to forego it. The prospect of a cold supper after a long and tiring march through the snow, with the thermometer below zero, would hold out no allurements, and indeed, from my small experience of a shortage of fuel under these conditions, I believe that few, if any, sledge-travellers could continue long without hot food.

So, at any rate for me, the sledge cooker is a matter of great importance, and it is here, if anywhere, that an immense advance has been made of late years in the sledging equipment. The cooking-apparatus we adopted was Nansen's, who, I consider, in devising this and adapting to it a modern form of heating-lamp, consuming paraffin in a vaporised state, made his greatest contribution to the sledge-traveller's requirements.

The principal requirement of a good cooking-apparatus is that it should allow a minimum wastage of heat, and though it is difficult to arrive at an exact figure, it is probably stated with some reason that the Nansen cooker expends usefully nearly 90 per cent. of the heat supplied by the lamp beneath it. The design of the apparatus pro-

vides that the heated gases circulate about the central cooking-pot, and after passing up inside the annular container, which we termed the *outer cooker*, descend again on the outside and thus give up most of their heat before reaching the open air. The greater part of the apparatus is constructed of aluminium, and the whole is made as thin as is compatible with the necessary strength in order to save weight.

I have already mentioned how at camping time the tent would be erected and the cook would retire inside with his provision bag and lamp; whilst he was lighting the latter one of the other members would fill the inner and outer cookers with snow and pass them into the tent, so that a very few minutes after the tent was up the lamp could be heard giving forth its pleasant music, and one knew that its heat was already acting on the frozen snow within the cookers.

Without wishing to take the reader into abstruse problems, I must here mention one of the physical properties of ice, which has a very practical bearing on the sledge-traveller. It may possibly be overlooked that it requires nearly as much heat to turn ice into water as it does to raise the resultant water to boiling-point. In other words, if the snow that is put into the cookers is at a temperature of $-36°$, it will take just as much heat to turn it into water as it does subsequently to raise the water to boiling-point.

The practical bearing is obvious: it means that the sledge-traveller requires nearly double the amount of fuel for cooking his meals that would be necessary if he could fill his cookers with water. Here again, therefore, he is handicapped in his struggle for existence.

The cook, having started his lamp under the cooker, proceeded to prepare the ingredients of the *hoosh*, by which term the hot, thick soup that constituted the sledging meal was generally known. Whilst he ladled

out a spoonful from one small bag and two from another, and added a little pepper and a little salt, he kept a watchful eye for the first spurt of steam which should signify that the water was on the boil. Directly this appeared, off came the covers and in went the assortment of food; in a very few minutes there was a bubbling and spluttering, and the tent was filled with the savoury odour of the coming meal. Not a moment was lost; with the steady hand of the expert handling a priceless possession, the steaming contents of the cooking-pot were soon being poured into the several pannikins. Then came the cleaning of the pot by the cook, whose perquisite this was; all that would not pour out in a fluid state was rapidly scraped out with a spoon and transferred to the cook's mouth. Without again employing the word 'cleaning,' I may say I have known worse ways of emptying a pot. In the meanwhile the snow in the outer cooker had melted, and so the water was all ready for transference to the inner vessel for the final brew of cocoa. As soon as this was on the boil the lamp was extinguished.

The excellence of this cooking-apparatus can only be gleaned from a citation of figures. With it, boiling water could be made from snow in twelve minutes; a simple one-course meal could be prepared in less than twenty minutes; and a two-course meal—that is, a *hoosh* with hot cocoa to follow—could be provided with a lapse of less than half an hour between the time the lamp was lighted and its extinction. Except for further economy of fuel, a more rapid apparatus would have given no advantage, for, as it was, the supper was generally ready before all the outside camp work, such as securing the tent and sledges, &c., could be fully accomplished.

The immense advantage which we possessed in this respect can be gauged when it is recalled that McClintock

speaks of the inevitable wait of two hours which his parties had to endure, after a long day's march, before they could hope to get warmed food; or, again, when it is stated that the records of the Arctic sledge journeys of 1875 show that the cook was always called two hours before the remainder of the party. With us, on more than one occasion, a very rapidly prepared brew of tea has saved serious trouble from freezing, and this alone made possible those exceptional efforts of marching in which we occasionally indulged.

In our rapid cooking the lamp was, of course, an even greater factor than the cooker; after some consideration we had adopted the Primus lamp which Nansen had found so useful. When in good working order nothing could exceed the efficiency of this lamp. The oil, which is pressed up into the upper tubes, is vaporised by the heat, and the vapour, emerging through a small pinhole, burns with a flame of intense heat, and effects the most complete combustion of the oil. In the rapidity and completeness of the combustion lies its great advantage. It has serious disadvantages: it is complicated and difficult to repair; it is likely to get out of order unless both the lamp and the oil used in it are kept absolutely free from dirt and grit; and when out of order it is quite useless. Moreover, the vaporisation has to be started by outside artificial means, the correct method being to fill a small outside cup with spirit. From these various defects we had at first much trouble, more especially as the sailor is inclined to be rather heavy-handed and careless with delicate mechanism. Later on, however, the men realised how much depended on keeping the lamps in good working order, and in consequence became very expert in handling them. Our confidence in them grew as we came to understand them better, and in spite of their defects we ultimately placed such reliance on them that we never thought

of taking an alternative lamp. On two occasions, in fact, my party were away on very extended journeys with nothing to fall back on had our lamp failed.

As may have been gathered, the cooking and eating utensils of our sledge parties were not numerous. Besides the cooker and lamp, a folding pannikin of aluminium was provided for each man, one half of which could be used for his *hoosh* and the other for his cocoa. In addition each person had a dessert-spoon.

Pannikins and spoons could be conveniently stowed inside the cooker for transport, and the latter then added 15 lbs. to the load, beyond which an extra weight of 2½ to 3 lbs. had to be allowed for the Primus lamp.

The oil was carried in small rectangular tins, which fitted close to one another on a light platform on the sledge. Some of these tins had been made in England, but we had considerably to increase our supply by others made on board the ship. Each tin had a small cork bung, which was a decided weakness; paraffin *creeps* in the most annoying manner, and a good deal of oil was wasted in this way, especially when the sledges were travelling over rough ground and were shaken or, as frequently happened, capsized. It was impossible to make these bungs quite tight, however closely they were jammed down, so that in spite of a trifling extra weight a much better fitting would have been a metallic screwed bung. To find on opening a fresh tin of oil that it was only three-parts full was very distressing, and of course meant that the cooker had to be used with still greater care.

A full tin of oil weighed 10 lbs. and contained exactly a gallon, and this quantity, as a general rule, was the allowance for ten days for three persons. With care this was amply sufficient, and on the southern journey when our stock was somewhat short a gallon was made

to last fourteen and even sixteen days, but this meant very short commons.

The incidental weights of a sledge party were numerous, and depended greatly on the direction in which the party were going and on the nature of their work. Those who journeyed to the mountainous regions of the west were forced to go most fully equipped in this respect, and in planning a sledge journey in that direction it was especially maddening to see how the weights of indispensable articles mounted up, and ever cut away from the margin which remained for food.

The weights of a party naturally divide themselves under two headings: the permanent, which will not diminish throughout the trip; and the consumable, including food, oil, &c. The following is a list of permanent weights carried on my own journey to the west; it will give some idea of the variety of articles which were taken exclusive of provisions; the party numbered six:—

	lbs.		lbs.
2 Sledges with fittings complete	130	Bamboos and marks . .	11.5
Trace	5	Instruments and camera .	50
2 Cookers, pannikins, & spoons	30	Alpine rope	9
2 Primus lamps, filled . . .	10	Repair and tool bags, sounding-line, tape, sledge brakes	15
2 Tents complete	60	Ski boots for party . . .	15
2 Spades	9	Ski for party	60
2 Sleeping-bags with night-gear	100		
Sleeping-jackets, crampons, spare finneskoes . . .	50	Total	568.5
Medical bag	6		
3 Ice-axes	8		

Although our sledges weighed little over 40 lbs. each, by the time they had been fitted with tanks for the provisions, platforms for the oil, boxes for the instruments and for the Primus lamps, and straps for other articles, it will be seen by how much their weight had risen.

Some of the other items may need a word or two of explanation. The spades were of course needed for digging up the snow to secure the tents. The night-gear consisted of warm foot-wear for the night, and a small bag containing one or two spare pairs of socks, a spare pair of mits, possibly a small amount of tobacco, and some extra grass for filling fur boots. This bag was always kept in the sleeping-bag, and was used by the owner as a pillow as well as a receptacle for diaries and the few oddments that constitute private property on such an occasion.

The heavy labour of marching made it possible to undertake it in comparatively light clothing; but on coming to camp it was generally necessary to put on something extra. In this garment also we slept, wherefore it figures as the sleeping-jacket. It was usually made from a woollen pyjama jacket, and lined with some extra woollen material. Of course all personal property was strictly limited by a given weight, and if a man chose to forego a pair of socks and take out the weight in tobacco, he was at liberty to do so. I remember gazing at my spare mits and wishing to heaven I'd brought tobacco instead.

The crampons were a necessity for travelling over smooth ice or very hard wind-blown snow. For the second year we invented and made a particular pattern of our own, which suited us admirably, and which I shall describe in due course.

Our medical bag contained bandages, sticking-plaster, an emulsion for sprains, a few phials containing medicines in the tabloid form, and a tube of hazeline cream. The general health of our sledge-travellers was so good that I believe, with the exception of two, the medicine phials were never required; the two exceptions contained zinc sulphate and cocaine, the first to cure and the second to deaden the pain of snow-blindness. As

this disease was a constant companion, these tabloids were very frequently needed.

The ice-axes mentioned above were of the ordinary Alpine type; they came in very handy for various work on the glaciers, but they were seldom absolutely necessary.

The title 'bamboos and marks' includes sticks and flags taken to measure the movement of the ice of the glaciers and to mark the positions at which we left our depots of provisions.

The contents of our instrument-box were an extraordinarily heavy item, and yet there was nothing which we could have spared. They consisted of a small three-inch theodolite in its case, for taking observations of the sun and bearings, two small aneroids, a compass, two thermometers, a hypsometer, a small book containing logarithmic tables, and a camera, with plates. On this journey we took the half-plate camera with its slide-box, and although one almost groaned on seeing the weight it added, there can be little source of regret when one contemplates the pictures which Mr. Skelton managed to produce with its assistance.

Alpine rope was a thing one scarcely liked to be without when travelling in a country where crevasses abounded; the thought of a companion possibly hung up in one of these and his fellow men unable to reach him for lack of rope, was too grim to be thrust aside. The repair-bag was an important item; it contained the housewife, with needles, thread, &c., to repair our garments, a few strips of material to patch the tent, with sail needles and a palm, some hide thongs, some tough pieces of reindeer-skin for boots, and some spun yarn for lashings. A tool-bag was also very necessary, and contained pliers, files, a bradawl, a gimlet, &c., with some screws, nails, and binding wire for the repair of the sledges. The sounding-line and lead were provided for sounding

and taking temperatures in crevasses, but it was rarely possible to use them. The tape was also for glacier measurements, whilst the sledge brakes were introduced in hopes of saving the sledges on the down grade over slippery ice. They were of hemp, and proved of very little use.

We took ski boots on this journey in hopes of being able to use ski, and thinking they might be of service on the glacier; we used neither the ski nor the boots, and 'depôted' the latter at a very early stage in the journey. The ski we took on, thinking always they might be required, but never finding that they were so.

And here I should like to explain my attitude towards ski, more especially as since Nansen's journeys it has been very generally thought that they have revolutionised the methods of polar travel. I have mentioned in former chapters how delighted we were with our ski practice, and I have also called attention to an incident where some officers were able to push on with a journey because they possessed ski. The latter is really an extraordinary exception, and it is still more extraordinary that it should have been our first experience of Antarctic travelling. It naturally biassed us all in favour of ski, so that although a few remained sceptical, the majority thought them an unmixed blessing. Bit by bit, however, the inevitable truth came to light: it was found that in spite of all appearance to the contrary, a party on foot invariably beat a party on ski, even if the former were sinking ankle-deep at each step; while, to add to this, when the surface was hard, ski could not be used, and had to be carried as an extra weight and a great encumbrance on the sledges. The ski party still made a stand in their favour by stating that they saved labour, but even this could not be admitted when the facts were thoroughly known. It stands true to some extent for a party out of condition,

but the fact we gradually came to appreciate was that after a week's marching our legs got so hard that it troubled us little to plod on throughout the day whether the snow was soft or hard.

It will be seen, therefore, that our experience has led me to believe that for sledge work in the Antarctic Regions there is nothing to equal the honest and customary use of one's own legs. Progress may be slow and dull, but it is steady and sure. On my western journey, having no knowledge of the inland surface, I took ski. They remained on the sledge from start to finish. As we were contemplating them just before our return to the ship, one of my companions remarked, 'They've had a nice cheap ride,' and that about summed up the situation.

In the list of permanent weights which I have taken as an example of a sledge-load for six men, the reader will see that the various articles total 568 lbs.; roughly speaking, a man can drag from 200 to 240 lbs., but we rarely loaded our sledge parties much above 200 lbs.; this for six men would give a total carrying capacity of 1,200 lbs., and hence about 630 lbs. which could be devoted to provisions. Speaking again very roughly, this amounts to about six weeks' provisions for the party, so that this party, dragging at the start 200 lbs. per man, can go away for forty-two days and throughout that time remain entirely self-supporting. If the party is increased to twelve men, for reasons which I need not detail, the absence can be increased to seven weeks, or about fifty days. But neither of these terms is long enough to suit the ambitious sledge-traveller, so that he is forced to organise means by which he can prolong his journey. This can be done in two ways: he may go out earlier in the season and lay out a depot at a considerable distance towards his goal, or he may arrange to receive assistance from a supporting party, which

on a prearranged plan accompanies him for a certain distance on his road and helps his advance party to drag a heavier load than it is able to accomplish alone.

Both these plans were adopted on our longer journeys, and thus some of us were able to be absent from the ship for long periods and to travel long distances.

I have endeavoured to describe how a sledge party is housed and fed; it remains to conclude this chapter by giving some idea of how it is clothed, and this can be done very briefly. The sledge-traveller takes little more clothing than that in which he stands at starting; in fact, I have already mentioned the articles of which his spare wardrobe consists. They do not include a change of clothing, so that he sleeps and lives in the one costume until his return.

In our case officers and men were clothed in a similar manner, save for such touches as the fancy of the individual might suggest. Each wore a warm thick suit of underclothing, one or two flannel shirts, a jersey, or sweater, a pair of pilot-cloth breeches, and a pyjama jacket. A pilot-cloth coat or any stiff garment about the upper part of the body was unpopular, and personally I cut off the sleeves of my pyjama jacket so that it was practically a very free-and-easy outer waistcoat. Some wore woollen comforters, but others, like myself, found the collar of the pyjama jacket sufficient covering for the neck.

Of great importance we found it to have many pockets, and a large breast-pocket was very generally adopted. It was here that in hard times by day one dried one's night socks, and by night those which one had worn during the day. Besides this, one's pockets contained a collection of miscellaneous articles: a knife, a matchbox, goggles, a whistle, and odds and ends such as string, thongs, and so forth.

Braces were another matter on which there was

difference of opinion. Some thought them indispensable, but I, with others, found that a leather belt served all needful purposes in this respect.

But one of the most important parts of our sledging-costume was the complete outer suit of thin gaberdine, a material manufactured by Messrs. Burberry for use in many climates. It purports to be water-tight, but of this we had little chance of judging; we required it only to keep out the keen edge of the wind and the drifting snow, and for this it was admirably adapted.

We found it very desirable that this suit should be very easily put on or off. On fine days it was convenient to march without it; but when the wind sprang up or the sky looked threatening it was wise to don it at once. But to construct a suit which had this desirable quality and at the same time was impervious to snow-drift was by no means easy. The suit consisted of a blouse, breeches, and leggings, but whether the leggings should be attached to the breeches, and how exactly the neck, sleeves, and other parts of the blouse should be fitted were matters of keen controversy, eventually decided according to individual taste. It is impossible, therefore, to give any very definite opinion as to the best form for these garments; subject to their being easy to put on and off, one great thing is that they should fit as closely as possible about the neck, wrists, and ankles, and that there should be no admittance for snowdrift between the blouse and trousers. It is almost equally important that there should be as few creases as possible, especially about the legs, as the snow which lodges in these is bound to be brought into the tent.

The parts of the body which need the most careful protection are the extremities, and here, again, everyone had his own ideas and his own patent devices. To face the cold of the early spring we had thick camel-wool

helmets provided with gaberdine covers, but many of us found these too heavy, and when they became coated with ice they were particularly unmanageable. A better plan was to use one or two ordinary woollen *Balaclava helmets* under the gaberdine cover. Personally, I used one, provided with an extra thickness of material to cover those most sensitive organs, the ears. I have already described the wind-guard which most of us wore to protect the face.

In summer, when the glare was very great, we wore broad-rimmed felt hats, either over a *Balaclava* or fitted with a special protection for the ears and back of the neck, which could be lowered or tucked into the crown according to circumstances. It is a great mistake to have too heavy a head-covering; the ice which inevitably forms on it in cold weather is sufficient to make a light helmet comparatively warm.

On our hands, when sledging, we wore either fur or felt mits over long woollen half-mits which extended from the elbows to the knuckles. These half-mits were excellent things, as one could draw them forward to assist one in handling the cold metal cooking-utensils or could curl one's fingers back under their protection when the tips became particularly cold. Personally I swore by our wolfskin fur mits. We wore them with the fur outside, and I lined mine with light wool and found that one pair lasted me throughout each of my extended sledge journeys. The most convenient plan was to have these mits slung round the neck, as one could then withdraw one's hands at will without the prospect of finding the mits gone when one wished to resume them. For taking observations and for other trying tasks it was very convenient to have a pair of light woollen mits or gloves, but of these there was a great scarcity on board.

Of all parts of the person of which it is necessary to

have care the feet are the most important, and for clothing the feet in cold weather there can be nothing to excel the reindeer-fur boot or *finnesko*, which is made in Norway. It behoves the traveller to be most careful in the selection of these articles, as, though many are made for wear, many also are made for a tourist market and will prove quite unsuitable for his purpose. Here, again, a lack of time had prevented a sufficient care being taken in selecting the large supply which we purchased, and though we had a good number of excellent articles, others were weak and unsatisfactory. The difference is most marked—a good pair of finneskoes will stand many weeks of hard wear on snow, whereas a poor pair will be gone in a few days; the importance of selecting good pairs for a sledge journey is therefore obvious. Luckily we soon became fairly good judges, and so never actually ran out of foot-wear on our journeys, though we came very close to it.

The sole of the finnesko is made of the forehead skin or the hard skin of the legs of the reindeer; it is important that it should have a twist in the natural growth of the hair, as this gives a better foothold. The upper sides are made of softer skin from the neck or legs; all the joints are very carefully sewn with gut, and the boot is worn with the fur outside.

To examine a pair it is necessary to turn them inside out, and this is not easy to do until they are made damp. With experience it is then possible to see the quality of the sewing and the probable lasting power of the sole. The Lapps make a nest of grass inside these boots and place their foot in this nest without further covering. There is an advantage in this in the fact that the grass can be taken out and the frozen perspiration shaken clear, but the custom probably springs from the absence of wool. This grass is called *sennegræs*. We had provided ourselves with a good quantity; but we wore

two pairs of socks inside the finneskoes, and only used the grass to pad out the toes and sides. Finneskoes are provided with a draw-string at the top, but we found that the best means of securing them was with a long strip of lamp-wick, which was wound about the ankle and covered the joint between the legging and the boot. Instances of seriously cold feet in finneskoes were extremely rare, and usually after an hour's marching one's feet perspired freely in the coldest weather. One great advantage is that there is absolutely no restraint to the circulation.

Before leaving the subject of dress one ought to mention the goggles, which were worn almost as constantly as many of the articles I have described. A few men preferred the ordinary wire-gauze type with smoked glass, but a drawback to these was their liability to become frosted over. The alternatives were to have a piece of leather with a slit in place of the glass, or to have goggles cut out from a slip of wood. Personally I much preferred the latter, and in the end invariably used them; mine were very carefully shaped to fit over the nose and eyes, had a considerable cross-shaped aperture, and were blackened outside and in.

One other article of sledge furniture deserves notice—the harness. Each man had a broad band of webbing passing round his waist and supported by braces over the shoulders; the two ends of the band joined in an iron ring, to which a rope was attached which could be secured to the sledge or the trace. In the old days men were accustomed to pull from the shoulder, and thus of necessity assumed a somewhat lop-sided attitude; with our arrangement, by adjusting the braces the weight could be distributed very evenly over the upper part of the body, and this I believe made the pulling easier and gave greater freedom for breathing.

From the foregoing the reader will, I hope, have

gathered some general idea of the objects and methods of sledge-travelling. He will see how varied is the assortment of articles with which the traveller provides himself; he will understand something of the rigid nature of the sledging routine and the simplicity of the sledging life; he will perceive how the sledge party are housed, and fed, and clothed, and how their absence is prolonged. Above all, he will realise how dependent is a sledging expedition on the efficiency of its organisation and the care of its preparation.

CHAPTER XI

TYPICAL SLEDGING EXPERIENCES

Use of Dogs for Sledging—A Discussion of their Merits—History of our Dog Team—Discomforts of Sledge-travelling—Typical Experiences—The Ordinary Routine—Result of a Blizzard—Benefit of Summer Temperatures—Disadvantages of Summer—The Fascination of Sledging.

> By mutual confidence and mutual aid
> Great deeds are done and great discoveries made.—ANON.

> 'Tis a weary round to which we are bound
> The same thing over and over again;
> Much toil and trouble.—LINDSAY GORDON.

FROM the outline of our sledging arrangements which I have given in the previous chapter, the reader will understand the occupation of our time and thoughts throughout the later months of the dark season. Yet this outline has been necessarily of a fragmentary nature, and I am conscious of having missed many points of importance. To one of these, at least, I ought to refer, since the chapter has made no mention of our four-footed friends, who were to play so important and tragic a part in our longest journey.

The use of dogs for sledging is a subject about which there has been much controversy. Broadly speaking, there are two ways in which dogs may be used—they

may be taken with the idea of bringing them all back safe and sound, or they may be treated as pawns in the game, from which the best value is to be got regardless of their lives.

In the first case their value is indicated by a direct comparison of their pulling power and food requirement with that of the man. McClintock, who had much experience in this matter, has said: 'Two dogs require the same weight of food as one man, and they will draw a man's full load for about one-fourth a greater distance than the man would. If both man and dogs are but lightly loaded, the dogs will almost double the distance which the man could do.' To this may be added that the dog requires no sleeping-bag, tent, or cooking-apparatus, nor, indeed, any of those articles which figured so largely as the permanent weights of a sledge party. Most authorities agree that 100 lbs. is about the maximum load for a dog, and few place its food for a long journey at less than 1½ lb. per diem, or something over half the weight consumed by a man.

So far, then, it would appear that a dog is a more efficient machine than a man; but, on the other hand, it has to be remembered that the dogs cannot travel without man, and they have therefore, in addition to their own food, to carry the food and *impedimenta* of their drivers. Moreover, the dog is fickle and unstable: its best performance, which has sometimes fallen little short of the marvellous, has been on short journeys, over beaten tracks, and with a light load; sustained effort with a heavy load over a new track seems always to have shown the dog in a much less favourable light. Difficult as it is to ascertain the reason exactly, the fact remains that no very long journey has ever been made by a wholly detached dog-team in the Arctic Regions, from which the animals have returned alive. The subject is complicated, and I am aware of treating

it somewhat summarily, but I am inclined to state my belief that in the polar regions properly organised parties of men will perform as extended journeys as teams of dogs, provided always that it is intended to preserve the lives of the dogs.

But if, on the other hand, it is decided to sacrifice the dogs to the supreme object of the journey, the matter is placed on a different footing, and the dog-team is invested with a capacity for work which is beyond the emulation of a party of men. To appreciate this is a matter of simple arithmetic. We can suppose a party of three men starting on a journey dependent on their own labours, and we can suppose the same party starting with the assistance of twelve dogs which they intend should feed on one another. In the latter case, although the party start with heavier weights than in the former, the dogs not only draw this heavier load but carry their own food on their own legs. It is obvious, therefore, that the dog-assisted party will have the radius of the simple man party *plus* the distance added by the dogs' energy. This is not quoted as a practical case, but merely to show the clear gain which the dog offers.

This method of using dogs is one which can only be adopted with reluctance. One cannot calmly contemplate the murder of animals which possess such intelligence and individuality, which have frequently such endearing qualities, and which very possibly one has learnt to regard as friends and companions. On the other hand, it may be pointed out with good reason that to forego the great objects which may be achieved by the sacrifice of dog-life is carrying sentiment to undue length. It is a case, if ever there was one, where the end justifies the means. There is no real reason why the life of a dog should be considered more than that of a sheep, and no one would pause to consider the cruelty of driving a diminishing flock of sheep to supply the

wants and aid the movements of travellers in more temperate climates.

If one comes to look into this matter, one sees that the real cruelty to a dog lies in overworking or underfeeding it, and it is in avoiding this as far as possible that the sledge-traveller most truly shows his humanity. The avoidance of unnecessary pain should be the aim, and suddenly and painlessly to end the life of an animal which has been well fed and well cared for is not cruelty. Unfortunately, it is not always possible to avoid pain, and it was this fact more than the actual killing that weighed heavily on us when, as I shall relate, we had gradually and completely to efface the patient companions of our southern sledge journey.

My plan for utilising our dog-team was compounded of the two methods which I have sketched above. We faced the situation that the weaker animals must be sacrificed to the exigencies of the work, though we hoped that a remnant of the larger and stronger beasts would survive to enjoy again a life of luxury and ease; but, as events turned out, we saved none: all were lost under the unavoidable pressure of circumstances.

Probably our experience was an exceptionally sad one in this respect, but it left in each one of our small party an unconquerable aversion to the employment of dogs in this ruthless fashion. We knew well that they had served their end, that they had carried us much farther than we could have got by our own exertions; but we all felt that we would never willingly face a repetition of such incidents, and when in the following year I stepped forth in my own harness, one of a party which was dependent on human labour alone, it would not be easy adequately to convey the sense of relief which I felt in the knowledge that there could be no recurrence of the horrors of the previous season.

I have endeavoured to give a just view of the use of

dogs in polar enterprises. To say that they do not greatly increase the radius of action is absurd; to pretend that they can be worked to this end without pain, suffering, and death is equally futile. The question is whether the latter can be justified by the gain, and I think that logically it may be; but the introduction of such sordid necessity must and does rob sledge-travelling of much of its glory. In my mind no journey ever made with dogs can approach the height of that fine conception which is realised when a party of men go forth to face hardships, dangers, and difficulties with their own unaided efforts, and by days and weeks of hard physical labour succeed in solving some problem of the great unknown. Surely in this case the conquest is more nobly and splendidly won.

It must not be forgotten, however, that few expeditions can command the numerical strength to perform extended journeys with men alone. A large party of men is not only a great responsibility, but a great expense; the dog gives little anxiety, requires no housing, and draws no wages.

There is one other point which must not be omitted in considering the relative services of dogs and men. There are places where men can go but dogs cannot. The greater part of polar travelling has lain over flat sea-ice or comparatively flat land-ice, and this is a condition suitable to the dog; but on steep slopes and over uneven country the dog is practically useless. It will be seen that a great deal of our travelling lay over uneven country. Everywhere but on the barrier surface we had inequalities to contend with, and in rising to the steep mountain ranges to the west we had to ascend rough uneven glaciers and to traverse surfaces of smooth glassy ice, where dogs would have been a hopeless encumbrance; men, and men alone, could have dragged our sledges over these rugged tracts. As we were situated,

therefore, the services of dogs could only have been utilised to a limited extent, nor is it at all improbable that a similar experience awaits future Antarctic travellers.

For some time before the start of our sledging season we had strained inventive talent in the hope of devising the best form of harness for our dog-team, one which would give them the best chance of utilising their strength; but in this respect a dog is a most uncanny animal to suit. Except after an exhausting march he is never still: he will leap about and turn and twist in a manner calculated to tangle the simplest harness, and to this he adds an ineradicable habit of gnawing at his trace.

The harness, as regards the dog itself, we kept a permanency. Each dog was measured for his suit, and then it was sewn securely about him. It consisted of a broad breast-band secured to a girth about the fore part of the body. The trace could be secured on either side of this arrangement. At first we tried a double trace to equalise the pull, using some small steel rope, impervious to the animals' teeth. This promised well, and, fitted with swivels, it was a really ingenious contrivance; but we found later that the wire, though very flexible, was liable to chafe, and when the small, sharp strands stuck out at all angles it was not pleasant to handle. Finally we had to revert to the single trace of rope, which was secured to the harness with a hitch and to the main trace with a toggle; whilst half-way along it was a swivel, which helped to counteract the constant restless twisting of the animal.

We also had many trials to find out how the dogs should be placed with regard to the sledge, finally arranging a long central trace, along which they were secured in pairs. Thus arranged our dog-team trailed out to rather a long procession. First came the leading dog, led

by one of the party; after him, two by two, the remainder of the team, the 'wheelers' being close back on the sledge. Even with this simple arrangement the traces would sometimes be worked into a bad tangle, which it was only possible to unravel with bare fingers—a task that was not looked forward to with any pleasure, especially in the early morning. In this respect there is a curious habit in dogs, which appears to be some survival of a remote wild age, and which most people will doubtless have noticed: a dog rarely coils himself down to sleep without turning round several times, as though arranging some imaginary lair. However pleasing this habit may be to watch on ordinary occasions, one does not contemplate it with delight in a sledge dog, knowing that one will eventually have to disentangle the twisted confusion that results.

It may be of interest perhaps to explain briefly how we came to be possessed of a dog-team. In the early days of preparation which preceded our departure from London the subject of dogs very naturally arose, and it became evident that if we were to obtain a team arrangements would have to be made in good time. The German expedition, which was to start simultaneously with our own, had already secured a team in Eastern Siberia, where, it is reported, the dogs are both larger and stronger than in the West. It was too late for us to copy this example, but I shortly got into communication with an agent, Mr. Wilton, who was then in Archangel, and who undertook to fulfil our requirements. At this time a Russian named Trontheim had been commissioned to obtain between 300 and 400 dogs for an American expedition, then about to start for Franz-Josef Land. It was Trontheim who in 1891 had secured the dogs carried on Nansen's famous voyage, and, as he was in all respects fitted for collecting the animals, our agent added our modest requirement of twenty to the

number of this commission, on condition that we, through our agent, should be allowed first pick of the crowd collected. The particulars of Trontheim's wanderings are not in my knowledge, but it is certain that he must have travelled over a great portion of the country inhabited by the Ostiak and Samoyede tribes of Northern Russia to fulfil his contract. On his return to Archangel Mr. Wilton selected twenty dogs and three bitches for our expedition, and duly brought them to London, where they were housed in the Zoo until such time as we could make arrangements for their transport to New Zealand and provide for their care on the voyage. I really do not think I ever had an opportunity of thoroughly examining the dogs until we came to rest in our winter quarters, but then, of course, one not only saw them, but rapidly grew to know their individual characteristics.

Notwithstanding the care with which they had been brought together, though the majority were fine, strong dogs, there was a distinct tail to our team, and several young dogs which had evidently never been in harness before. One of the most noticeable points about the team was the difference of breed. There were three distinct types, besides many modifications of these types. The first was a big, strong-limbed dog of nondescript colour, with a very thick but comparatively short coat; these animals formed the best pulling element in the team. Next came a short-legged, thick-set dog, with a long, shaggy coat, and black-and-white in colour; it was one of these who kept up the traditions of his race by pulling to the last gasp. The third type was in form and colour so near to the grey wolf that one felt confident that his blood relationship was extremely close. These dogs were by far the most unattractive in the pack; timid, cunning, and uncertain in temper, they possessed all the sneaking distrust of the wild animal

and none of the good humour and boisterous affection which were so marked a characteristic of the rest. And all this mixed team had come to us unnamed and unknown; we had not a scrap of their history, nor could we tell within a thousand miles whence they came. But what mattered that? They had now good Anglo-Saxon names, and their value lay in their future, and not in their past.

One fact only had been borne by word of mouth—the king and ruler of our pack had held the same high office when he had travelled amongst 400 of his kind. And well he might. His new name of 'Nigger' wholly failed to convey the grandeur of his nature. In peace he was gentle and dignified, but in war, as we knew to our cost, he was swift and terrible.

When we opened our spring campaign with the dogs in 1902, the original team had sadly diminished. One had been lost with poor Vince in the disaster of March; two had been murdered under our very eyes, and two others had come to an untimely end during the winter.

To what remained, for our southern journey, were added the three ladies and poor 'Joe,' who had been the private property of Mr. Bernacchi, bringing their number up to a total of nineteen, of which all but one, who was dismissed at an early period in the journey, left their bones on the great southern plains. This in brief is the history of our dogs, but of the circumstances in which they met their end I shall speak at greater length.

A mere description, such as I have given, of the organisation of sledge-travelling and the paraphernalia which accompanies a sledge party can give no idea of the actual life of the sledge-traveller or the difficulties and hardships which he has to face, so that it is necessary to point out wherein the latter lie. The worst time for sledging is the coldest time; not so much on account

of the cold itself as on account of the effects produced by the cold. The most troublesome of these is the absence of evaporation. Very cold air will only contain the minutest quantities of moisture, and consequently there is in it little or no drying effect, while the human body is always giving off moisture, much passing away in the breath, but much issuing through the pores of the skin. It is not difficult to see what will happen under such conditions, and how much the traveller will be inconvenienced. Though the greater proportion of the moisture will pass away with air artificially heated by the body a small quantity will remain as ice on one's garments, and this ice will gradually and surely increase until one is completely enclosed in it. There is ice everywhere: one's garments are covered with it; one's helmet is encrusted with it; one's boots are full of it; and all these things which on board the ship were so caressingly soft to the touch will have become as hard as boards. Worse still, this ice will be found plastered as thickly on everything that makes for comfort at night: sleeping-bag, night-jacket, and night foot-gear will have grown equally hard and chill; one's life seems to be spent in thawing things out.

Some idea of these discomforts may be gathered from the description of a day's sledging under severe conditions of temperature. We will imagine ourselves of a party who have been a week or more out, and first observe ourselves as we are plodding along through the snow towards our evening camping place. The exertion of the march has sent the blood coursing freely through our veins, and each man inside his heavy clothing has a grateful sense of warmth; but the day has been a long one, in the last half-hour the sledges have grown decidedly heavier, and legs and back are already giving warning that the camping hour ought to be at hand. Breath is now coming gustily; it has frozen thick under

the wind-guards and hangs in long icicles from the unshaven chins; eyelashes are thickly encrusted with it, and now and again a bared hand has to thaw out a sealed eyelid and restore the sense of vision to its owner.

Half an hour ago the leader looked at his watch and announced, 'Thirty-five minutes to camp'; by this time we can gauge shrewdly the passage of time and the watch has not been seen again until now, when it is followed by the caution, 'Three minutes more.' Heads go up; it is time to look for the camping spot. But we are now travelling over rough *sastrugi;* we cannot camp on these with any hope of comfort. Suddenly the owner of a keen eye says, 'There we are, sir'; he has detected a smooth patch just large enough for our tents, and we make for it. We march to the site and up goes the leader's hand. The sledges stop dead; traces and harness fall with a clatter on the snow, and without a moment's delay the heavily clad figures turn towards the sledges. There must be no standing about in this weather; we must be constantly active until we can creep into the shelter of our thin tent. Everyone is soon wrenching at the straps of the neatly packed sledges and running busily to and fro with various articles of the equipment. In each group of three, one man seizes the tent-poles and after some struggling succeeds in planting them firmly in the snow over the smoothest site he can find; his two companions advance with the tent, and whilst he holds grimly to the poles they whisk it over his head and straighten it till it hangs squarely on its support. One now pulls out and arranges the skirting, whilst the other has seized the shovel and is cutting out large slabs of snow as though his life depended on it.

I may here add that this was not always an easy task. Sometimes the snow was brittle and crystalline, and difficult to work; at others there was very little of it, espe-

cially when we camped on glaciers; but the worst condition was when it was excessively hard. It may seem almost incredible that we occasionally found wind-blown snow so hard that, except in the strongest hands, a solid sharp shovel made no impression on it. To prise out pieces at such times was really expert work, and it was lucky that we only came on this condition after we had had some experience.

But to return to our tent. Whilst the others are delving and securing the tent without, the cook has spread the floor-cloth within, and is now seated on it with his Primus lamp and provision bag. He handles the first with care, pours spirit from a tiny flask into the outer cup, and laying in it a small piece of wick proceeds to light it. His matches are produced with great care from an inner pocket. Herein lies great danger, for on no account must moisture be allowed to condense in that box; the contents of many a matchbox have been wasted by incaution. If he has been sufficiently careful, however, the lamp-wick is soon sputtering and thin blue flame creeps up about the burner of the lamp; with bated breath he waits for the psychological moment, and suddenly gives a sharp stroke to the plunger of the lamp. If he has hit it off, small shafts of blue flame shoot out beneath the caps, and in a minute, as he works away at the pump, the top of the lamp is surrounded by a hissing roaring flame. If, however, he has not hit it off, the yellow flame of free oil alone shoots up, and all has to be done over again. Meanwhile the cooker has been filled by those outside and handed in through the door. Directly the lamp is lit the various vessels are placed on top of it; the lamp takes a deeper note as it gets to its work, and those without breathe a sigh of relief as they realise that supper is now really in sight.

The cook now gets ahead with the contents of the provision bag and continues to suffer in comparative

silence, for indeed all this time he has suffered; he has had to work with bared hands and to seize one by one all these chilled metal articles, where a moment's delay will convey a tingling, burning shock to the fingers. Of such work it may be truly said:

> Ah me! what perils do environ
> The man who meddles with cold iron.

In our spring journeys it was impossible to avoid this trouble with cold metal; our fingers became to a certain extent callous, but only when each finger-tip terminated in a large horny blister. Except that they burnt and tingled, these blisters did not give much trouble during a short journey, but were very sore when they burst after one's return. On a long cold journey one's fingers were liable to split and crack about the nails, and this was both painful and troublesome.

As soon as the tent is well secured without, those who have been at work on it demand admittance; the door is unfastened and they come tumbling in with a confused medley of night-coats and foot-gear. All now squat round the hissing cooker, and we gain what comfort we can from the heat that escapes from it. The confined space within is now filled to repletion, and elbows and knees have to be managed with caution to avoid disaster to the cooker. By this time, in the spring, the sun has sunk below the horizon, and the gloom of the tent is lightened only by the flickering rays of a candle placed in a collapsible lantern which hangs from a tent-pole. So small is the space that an incautious movement often sends this contrivance flying, and there is much groping and imprecation before light can be produced again on the scene.

Whilst the cook devotes his attention to the all-important supper we others make shift to change our foot-gear;

in the narrow, cramped space we tug and pull at sodden finneskoes and ice-covered socks, and, diving into our warm breast-pockets, hasten to cover bared feet with the night-socks which have been dried in that receptacle. Suddenly, without warning, a leg shoots out whilst the owner exclaims loudly under the sharp pain of violent cramp. The cooking-pot rocks wildly, but in the confusion the ever-watchful cook rises to the occasion and prevents a catastrophe.

A few moments more, and little spurts of steam rise from the centre of interest; snow has been converted into boiling water, and the cook's busiest moment has arrived. Off come the lids and covers, and in a moment all is hidden in a dense cloud of steam, through which one can dimly perceive that the cook has seized the candle and with its aid is conveying the frozen ingredients of the supper into the boiling pot. Soon, as he stirs, the most fragrant odour in the world greets our nostrils. All other work ceases as the pot is lifted and its precious contents poured into the ready pannikins. The cook takes his perquisites by scraping out, with his spoon, all that remains; this done he refills the empty pot from the outer cooker and sets it once more to boil. Then follows an interregnum of comparative silence, broken only by the crunch of biscuit or the smack of lips which have closed on a succulent spoonful of *hoosh*.

This is a moment to be lived for—one of the brief incidents of the day to which we can look forward with real pleasure. The hot food seems to give new life, its grateful warmth appears to run out to every limb, exhaustion vanishes, and gradually that demon within, which has gripped so tightly for the past hour or two, is appeased. The *hoosh* is followed by an equally delightful drink of boiling hot cocoa, but even as we gulp it down we feel that pleasure is drawing to an end, for the Primus is now out, the steam of cooking that has not passed away through

the ventilator has frozen in glistening crystals on the side of the tent, and the chill of the outer air is again finding its way through the thin canvas.

There is no time to be wasted; the door is opened, and two people plunge out into the open air, the cooker and provision bag are hastily packed together, passed outside, and made secure from the wind by heavy lumps of snow; the floor is swept, and the miscellaneous assortment of clothing is collected with as much discrimination as possible into the corners allotted to the various individuals. Meanwhile the sleeping-bag is dragged to the door of the tent, and by dint of much coaxing it is eventually got inside. By this time it is quite stiff and hard; it crackles as it is forced open, and has to be flattened out with the full weight of the body. What was once the soft covering flap will now stand erect and rigid, so stiffened is it with ice. Inside, the hair is matted together and hard frozen—so hard in places that under the raps of one's knuckles it resounds like a wooden door. Could any bed be more uninviting?

Before we enter it we must have a look round. The sun is skimming round below the southern horizon; there is a deep red flare in its wake. The sky is clear save in the south-east, where lies a rather ominous bank of cloud. Are we in for a blizzard? Now and again a puff of wind sweeps over the snow; as it passes, the fine ice-crystals of the surface-drift patter against the sledges and our legs and gather in little sandy heaps beyond; the tent, which has been flapping idly, shivers violently as the blast sweeps by; a last look at the thermometer shows that the temperature has fallen to −48°; we wonder how much lower it is going, and make for the tent door.

It doesn't do to dive straight in, for we may land in the centre of some one else's anatomy, so we shout, 'All right for coming in?' There is a scuffling, then 'Right,

oh!' and we dive with a blind lurch towards our own corner; the last-comer gathers up the loose folds of the door and ties them up tightly; then we all sit round on the sleeping-bag and complete our costume for the night. It is breathless work this, dealing with hard frozen garments in such a cramped space. Conversation is kept up in gasps, and now and again some struggling figure has to pause for a rest; but at length all are ready, and, sweeping away the loose snow as far as possible, we lift the flap of the sleeping-bag and step inside.

But the day's work is not yet over; this is the time for diaries, meteorological records, casual repairs, *and pipes*. The last-named, being the only attractive part of this programme, is the first to be considered, and each smoker's hand dives into the inner recesses of the pocket in which pipe, matches, and his meagre allowance of tobacco are cherished. Experience soon teaches that a pipe must be kept in a very warm place, otherwise the stem will be found choked with ice, with which nothing but a stiff bit of wire will cope.

A diary is a great nuisance when the nights are dark: the writer is obliged to secure the flickering lantern close beside his book, and when the tent is being shaken by the wind the fitful motion of the light can be imagined. As he pores over his task his breath forms a film of ice over the paper, on which the pencil frequently skids, and sometimes after writing a few lines he will turn the page to the light and find half of it illegible, so that he has to go painfully over each word afresh. Now and again his bare fingers will refuse duty, and he must wait awhile until they are nursed back to life. This sort of thing does not help one's ideas to flow, and altogether the keeping of diaries and records is no joke in this cold weather. Sewing is a still less pleasant job, and the garment must be badly rent indeed before its owner undertakes its repair on a spring journey.

As these tasks are finished, one by one the inhabitants of the sleeping-bag wriggle down into its horny depths. The last to lower himself is the centre man, who has still some duties to perform. When the others have reported themselves fixed, he laboriously wrestles with the fastenings of the bag over their heads; these secured, he 'dowses the glim' and works himself down as best he can between his companions, and finally seals the opening above his own head. Ere this dreaded night commences, the leader has again consulted his watch and found that between two and three hours have elapsed since the party halted.

The time consumed in all these simple operations of camping puzzled us greatly at first. There was no particular delay anywhere; from start to finish one was busy, and there was every incentive to hurry, yet even with experience the interval was very little shortened. The secret lies in the fact that the simplest operation becomes complicated in intensely cold weather. Even to change a pair of socks takes nearer five minutes than one. The continuous thawing-out is the real cause of delay, but the difficulty shows that the sledge-traveller has much to occupy him in cold weather beyond dragging his sledge over the snow.

A night in such a sleeping-bag as we are picturing, with the temperature below −40°, cannot be said to be less than horribly uncomfortable. We are rarely conscious of sleeping; certainly not oftener than one night in three can we realise that several hours have passed in oblivion, and these seem only to be bought at the price of extreme exhaustion. Ordinarily we sleep in the fitful, broken, comfortless fashion of which the mere recollection is a nightmare, and even this poor apology for slumber does not come until we have lain broad awake and shivering for an hour or two.

With the temperature at −48° we can make a shrewd

guess as to the sort of night that is before us. The first half-hour is spent in constant shifting and turning as each inmate of the bag tries to make the best of his hard mattress or to draw the equally hard covering closer about him. There is a desultory muffled conversation broken by the chattering of teeth. Suddenly the bag begins to vibrate, and we know that someone has got the *shivers*. It is very contagious, this shivering, and paroxysm after paroxysm passes through the whole party. We do not try to check it; the violent shaking has a decidedly warming effect; besides, it is a necessary part of the programme, and must be got through before we can hope for sleep. Presently we hear our neighbour marking time, and we rather unnecessarily ask him if his feet are cold; he explains their exact state in the most forcible language at his command.

All this time we are mentally surveying our own recumbent figure and wondering whether the parts that feel so cold are really properly covered or whether our garments have got rucked up in the struggle for ease. Our hands are tucked away in some complicated fashion that experience has commended; they are useless for exploring. Besides, we know of old how far imagination can lead one. Our thoughts, taking flying journeys round the world, flit past the tropics to log-wood firesides, but they stop nowhere until they have raced back to present discomfort. The last squirm brought the wind-guard of our helmet across our face. It is crusted with the ice of the day's march; this is now gently thawing, and presently a drop trickles down our nose. Our thoughts become fixed on that drop. It is very irritating; we long to wipe it away, but that means taking out one hand and disarranging the whole scheme of defence against the cold. We are debating the question when a second drop descends. Flesh and blood cannot stand this: out comes our hand, and for the

next quarter of an hour we are pitching and tossing about to try to regain the old position.

It is all very small, very trivial; yet there are probably few who have not passed sufficiently restless nights to appreciate how these trivialities weigh on such an occasion, and here we have in their most concrete form the greater part of those elements which go to disturb the rest of man.

We start to count those imaginary sheep jumping over their imaginary hurdles for the hundredth time as the shivering lessens. The last half-hour has brought a change; we are no longer encased with ice. There are signs of a thaw; above and below the bag is less rocky; it is becoming damp and coldly clammy, but it covers us better. There is just a suspicion of somnolence, when suddenly the whole bag is shaken violently and we hear the most harrowing groans. It is only another attack of the cramp, an enemy that is never far away. We try to sympathise with the victim as we start the sheep jumping afresh.

And so this wearisome night passes on, with its round of trivial detail and its complete absence of peace and comfort. It was the same last night, and it will be the same to-morrow.

It is not an exaggeration to say that we dreaded these nights, yet it is worthy of record that none passed without a jest; the more cheerless and uncomfortable the conditions became, the more light-hearted grew the men.

I have mentioned only some of their ills. Besides cramp, cold feet, and general discomfort, many were attacked by rheumatism; later, snow-blindness intervened. Another great source of trouble was indigestion and heartburn. I, with several others, had never known this ailment under ordinary conditions, but during the earlier sledging days it attacked us most fiercely. Also, of course, frost-bites were common, with painfully blis-

tered faces and hands; feet were likewise blistered on the long, fatiguing marches.

To all these ills were our sailors regularly and constantly exposed on their sledge journeys, and not only did they hate to forego their share, but never an evil fell on them but they made so light of it that one would have thought they were engaged in the most humorous occupation imaginable. Their conversation either on the journey or after their return could have conveyed only one impression—that the whole thing was a glorified picnic. It was not that the jokes were of a high order. The acknowledged humorists were in the minority, and even they were reduced to the feeblest witticisms; the striking thing was their capacity for finding amusement not only in the dull and prosaic, but in the physically miserable. There are few people, I take it, who will not appreciate the saving qualities of this sense of humour, or who have not at some time experienced the advantage of meeting misfortune with a smile; there are few, therefore, who will not realise that one would have to search far for a better sledge-companion than the British bluejacket.

If refreshing sleep comes at all on a spring sledge journey it will be in the early morning hours, when the sleeping-bag has thawed down on its occupants, and they, though damp, can get better protection from its folds; it is now, therefore, that we doze for brief intervals and wake in fitful starts. The leader, who alone possesses a watch, is conscious of his responsibility for rousing the party, and wonders vaguely in his waking moments what the time may be. To look at his watch is a thing only to be done when all other evidence as to the passage of time has been duly considered, for it means that his present attitude has to be disturbed; he must struggle with his garments to produce the watch, and, worse still, he must slightly open the sleeping-bag

so that the grey outer light may fall on its face. Therefore before he moves he recalls the incidents of the night and sums up in imagination the intervals of time which have elapsed between them; he arrives at the conclusion that another half-hour may well pass before he disturbs himself.

Then the deed has to be done, and he shuffles the watch-face up to the light. As he peers into it his breath freezes on the face, and he has to rub again before he can mark the position of the hands, but finally they show that there is still a quarter of an hour to the time of rising. He tucks away his timekeeper and lies wakefully counting the minutes. When he thinks the fifteen have elapsed he shouts, 'Time to get up!' It is evident the others have been waiting for the signal. There is no lagging; even the morning hours have not made the bag sufficiently comfortable for anyone to desire to linger in it. The toggles are soon undone and we all hoist ourselves into a sitting position and search about us for mits and other articles of attire. A prolonged howl is sent forth into the dim morning light, 'Rouse out! Rouse out! Time to get up!' and presently one hears the muffled response from the other tents, 'A' right, sir!' A moment or two more, and all are busy again.

The murmur of conversation in the other tents comes to our ears, and occasionally some remark intended for the whole camp. Two of us have tumbled out through the door of the tent, and the moist sleeping-bag is dragged through to be rolled up outside. The cook has already dashed for his Primus lamp; the cooker is filled and passed in, and soon the hissing sound in each tent tells that breakfast preparations have commenced.

We take a swift run round to the other tents to inquire the news of the night and make a rapid survey of the various ailments; then on to the thermometer to find the spirit column resting at $-45°$, though the indicator

shows that it has been colder in the night; its upper end is resting more than 50° below zero (in fact, on spring journeys it was often found below −60°). The temperature is slowly rising, but it is still bitter enough as we seek again the shelter of the tent.

It is lucky that the watched pot does occasionally boil, for all eyes are now glued on the cooker, and, thanks to its efficiency, no long time passes before the pemmican can be thrown in, and the savoury smell of breakfast arises. With breakfast, peace and comfort again reign for a short spell, and whilst its grateful warmth is still felt we puff again at our pipe and collect as best we can our boots and other articles necessary for the day's march. The sun has just risen above the horizon, but the wind has come with it, and its golden rays are reddened by the low driving snowdrift. Some of the worst ordeals of the day are before us, and to venture into the open in the wind is not a pleasing prospect. Faces take rather a grim expression, but delay doesn't help matters; things have to be done, and they are done somehow. With the coming of the sun the flickering lantern can be dispensed with, and now we can see well to put on our marching boots.

It is very trying work. With a caution born of experience we took immense care last night in freezing them to conform as nearly as possible to the shape of our feet. After the march they had been wet through, and came off in a soft and flabby condition; we knew that this would only last for a few minutes, and as they froze we had carefully supported and kneaded them into the required shape. Half an hour later they were so hard that we could throw them about without risk of altering it; they are still in this condition, and we are about to test the result of our labours. They clatter like wooden sabots at they are deposited on the floorcloth.

We squat down and withdraw one foot from its night-

clothing, grope in our breast for our day-socks, produce one of them still very wet but moderately warm, jam our foot into it, and with many gasps proceed to wedge it into a wooden finnesko. The finnesko has been prepared by placing in it a sole cut from reindeer-skin and a little padding of *sennegræs*. This grass is soft, but the sole is as wooden as the boot, and has needed much pushing to get it in place. We are lucky if our foot gets half-way into its rocky cover at the first attempt. We leave it at that for the moment, and proceed with the other; by the time it is in a similar position, an inch can be gained on the first, and so inch by inch these tiresome boots are pulled on. Meanwhile our feet have got alarmingly cold, and with a groan we are obliged to start up and stamp about.

There is no exaggeration in the above picture. The putting on of our finneskoes in very cold weather was generally a matter of excruciating agony; it often brought tears to the eyes and always strong expressions to the lips, and all this with footwear that on board the ship could be put on as easily as one's hat. Yet even when one was fuming in this discomfort, a glance at one's writhing companions made it impossible not to appreciate the humorous side of the situation, and we have often paused in the midst of our trying labours to indulge in a real hearty laugh.

Heaven help the man who had failed in caution on the previous night! At first, from want of experience, and later from carelessness or by accident, a boot would be found in the morning squeezed flat and frozen hard in that impossible shape. There was nothing for the owner to do but to thaw it into shape with his foot, which had to be withdrawn at intervals and rubbed violently to restore the circulation. The least time in which one could hope to cope with a boot of this description was half an hour.

By this time all have their foot-gear on, and have readjusted all their clothes ready for the march. Considerably over two hours have elapsed since we roused out of the sleeping-bag. When all is ready comes the order, 'Pack up.' Out tumble all the thickly clad figures; lamps, cookers, and sleeping-bags are bundled into their proper places on the sledges, the snow is shovelled off the tent, and the latter is whisked off its poles, shaken, and folded up; the floorcloth is rolled up or secured to a bamboo to serve as a sail. All these articles are soon piled on the sledges and securely strapped down; the camp has disappeared as though by magic, and all that is left to mark the spot is the weird circles of snow-blocks which held the tents.

The warming effect of breakfast has long since vanished, and now all is eagerness to be on the march. The harness is soon picked up from the snow and adjusted about the body; then, with a final look to see that nothing has been left behind, we bend to the traces and the leader says, 'Off.'

There is rarely much conversation on the march, especially in cold weather; and, starting with a quick, warming step, it is not long before we have fallen into our regular stride—that steady rhythmic plod before which the miles come slowly but surely. In half an hour's time the blood is flowing freely, garments are hanging more easily, and our boots have thawed sufficiently to give to the step. A halt is called to tighten up our lamp-wick straps and to readjust the folds about our legs to the new conditions; then we are off once more.

And now hour after hour creeps on whilst we seem to have turned into a machine—a machine that must keep moving with that regular swinging step, and now, thank heaven, a machine that can do so without straining its parts. A week ago things were very different; we vividly remember the start of the journey, when, in spite

of the temperature, the perspiration ran off us, when our legs seemed uncontrollable members, and our back one huge ache. Since that, day by day we have grown stronger on the trail, until now the early hours of the march are almost a physical pleasure, and it is only towards its end that we feel the weight of the sledges. Yet withal progress is not rapid; one and three-quarter mile an hour is good going. Sometimes we come down to one and a half or less, and if we exceed two we seem to be racing. Still, even a mile and a half an hour produces a fair total for the day, if we can keep it going for nine hours or more. So we plod along mechanically, each footfall but little in advance of the last, whilst the sledges come jerkily in our wake and leave the long, snaky furrows behind.

At one o'clock there is a halt for lunch. Here we score, for in the old days with ponderous, dilatory cooking-apparatus the sledge traveller could not afford to take his luncheon hot, but with us the cooker is singing ten minutes after we halt, and in less than half an hour we have hot tea or cocoa; and whilst we munch our modest allowance of biscuit and cheese, the hot fluid once more sends the blood coursing through our veins.

I think there can be no doubt as to the benefit of this hot meal in the middle of the day, though possibly some hardened travellers may consider it an unnecessary luxury; it forms an oasis in the long desert of the day's march, it breathes new vigour and spirit into a flagging party. For lack of fuel I have been long spells without a hot drink at midday, and therefore I know well the difference it makes to the afternoon march; and though I know the case is not strong scientifically, I am prepared to affirm that the distance gained on the marches more than compensates for the extra weight of fuel required. Personally I always preferred cocoa to tea for this meal, mainly because tea is not a food, and can only stimulate.

The fact that we took tea on our sledge journeys was rather a concession to the men, who from habit are much attached to this beverage; indeed, there were one or two men who positively disliked cocoa. The best marching hours were always those which succeeded the lunch hour.

But an hour under these conditions literally flies, and we have barely swallowed our lunch and drawn a whiff or two from our pipes when the order comes to 'pack up'; tents and cookers are again packed on the sledge, harness is resumed, and we are once more on the march.

So mechanically and evenly go these marching hours that I have sometimes had to collect my thoughts to remember whether it is morning or afternoon, or even where I am and what I am doing. It is easy to go into reverie and fly away to the ends of the earth; nothing disturbs the silence but the regular crunch of the snow-crust and the swish of the sledge-runner.

But now the wind is springing up again. Throughout the day the clouds have been banking up from the south; they are now travelling fast overhead, a low flying scud. The sun peeps through at rare and rarer intervals, the sky and the mountains look very black and sombre, and throw up the intense whiteness of the snow; the surface drift comes whirling along in ghostly wreaths, and patters about our feet. The outlook is threatening, but we don't want to lose our miles if we can help it, so we plod along as before. As the wind grows stronger, one by one out go the face-guards, and we march with heads turned slightly to the right, away from it. We must keep our eye open for frost-bites now: they will give no warning. Presently the leader calls a halt; everyone knows what it is for, and each peers into the face of his next-door neighbour. Apparently all is well, and off we go again; a quarter of an hour later there is another halt and we hear, 'Your cheek's gone, Jim,'

and Jim immediately extracts his hand from his mit and places it over the offending feature. Also Jim knows that there will be a blister there to-morrow.

Once more we resume the march, and for long it is only interrupted by the occasional search for frost-bites. To the south the outlook appears still more gloomy, and presently some adjacent hill-spur disappears as though it had fallen through the earth, completely blotted out by a sheet of deep grey which is rushing towards us. This is the threatened storm, and the sooner we are in camp the better. We cast round for a camping ground and rush for the likeliest spot; we halt and dash for the sledges; we think of nothing but getting the tents up in time. But alas! we have marched just five minutes too long, and we have scarcely placed the tent-poles before the storm is upon us.

The air is thick with driving snow-crystals; they lash at our face like a sand blast. It is impossible to face them directly, and we rush to and fro with averted head. So thick is the air that we can scarcely see the sledges from the tent position, though only six or seven yards lie between. It is each party for itself now with a vengeance. One of our three hangs on like grim death to the tent-poles, whilst the others bear the fluttering, straining canvas to windward and strive to envelop him. Once or twice they fail, but at last the tent is over, and whilst to windward it is stretched taut on the bending bamboos, to leeward it is flapping madly in the rising gale. One of us sits on the weather skirt, and the other flies for the shovel and returns to dig with wild haste. It is a long and difficult job this, to set up a tent in a heavy wind whilst the snow curls and bites into our face and creeps into our mits and into every hole and crevice it can find in our garments. That wildly flapping skirting is only conquered inch by inch by the united efforts of the whole party. But it is bound to be done, and the

sooner the better, so we work with all the strength that remains to us.

We must have everything handy now, so when the tent is secured we fly for sleeping-bag, cooker, and anything else we may need, and bundle them all indiscriminately into the interior, following ourselves with all the haste we can compass. Only when door and ventilator are tied have we time to look about us, and then the sight is not pleasant. The powdery snow-dust lies inches deep everywhere; it has covered everything we possess, and lies thick in every crack of the sleeping-bag. We ourselves are white from head to foot, and none of us but is keenly frost-bitten about the face, whilst one has two of his fingers white to the knuckles. Something hot is what all need, and we set about to get it with the least possible waste of time, whilst we brush the snow as best we can from our belongings.

Supper makes one feel better, and immediately after we unroll the sleeping-bag and commence to prepare ourselves for entering it. We know from experience what all this snow will mean; we cannot wholly banish it, and the icy condition of our belongings is nothing to what it will be; yet we sweep and sweep as diligently as may be with our fur mits to make the best of a bad job, till finally we lift the cover of the bag and settle ourselves with all possible care within.

It is curious to lie like this in a blizzard; luckily the temperature has gone up, as it always does on these occasions. The rise is apparent in every way; we can handle things more easily, our breath does not rise in such steaming clouds; but, above all, there is a milder and easier feel in the air once one is out of the lash of the wind. Our discomforts now come more from the miserably chilly wetness of everything than from the actual cold.

Meanwhile the storm without is raging unabated, and

the thin canvas of the tent is flapping with a continuous roar that drowns all noise within; conversation can only be carried on by shouting. Still, the main point is that we are all in the sleeping-bag and safe and sound if not very comfortable, so in due course we settle ourselves in its depths and draw over us the protecting flap. There will be no shivering to-night at any rate, and we can smoke our pipes with greater ease in consequence; here, in the depths of the bag, the mad flapping of the tent has sunk to distant thunder.

The chances are that on the following day the blizzard will not have gone down; our blizzards usually last for more than twenty-four hours, and therefore next morning one is not surprised to hear the tent flogging away as wildly as ever. Breakfast is deferred for an hour, but man must live, and it is better to keep one's strength up at all times, so at last we all get out of the bag, roll it up carefully, and prepare our meal.

The meal over, the bag is spread again, and in it we while away the hours as best we can. It is an admirable lesson of patience, since we are absolutely incapable of bettering matters till the clouds roll by. We only allow ourselves two hot meals—a late breakfast, and then supper as darkness is again descending on us. During these meals the bag is rolled up, but lunch, with its scraps of biscuit, cheese, sugar, and chocolate, is eaten inside it; one keeps all these luxuries in a warm breast pocket and munches away at them at intervals.

How unutterably wearisome these long daylight hours are! The smoker looks ruefully at his small stock of tobacco; to smoke now is to rob the future, but the temptation is great, and he argues that just half a pipe will not make much difference, so he lights up, but in a quarter of an hour finds himself sucking at an empty bowl. The inside of the bag has grown moist where it comes into contact with the body, whilst the ice is still

hard in the corners; the damp has worked through to the skin, and we seem to be swathed in wet bandages. It is horribly cold and clammy, and we think of what joy it would be to be able to walk into our comfortable wardroom, to rub ourselves with a rough towel, don dry clothing, and bask in the rays of the glowing fire.

Now and again conversation breaks out; someone tells a droll legend of his infancy; the tale carries us away to other places and other times for a space, forgetful of our miserable surroundings; but the effort flickers and dies, and gradually thought creeps back to the present. The small aneroid barometers are consulted again and again; there has been a slight fall for the gale, not more than two or three tenths of an inch, but we eagerly look for a rise; occasionally a head is raised out of the bag to contemplate the green canopy above, but no one cares to look long at the shivering canvas and trembling bamboos; a glance is sufficient to show that the conditions without are unchanged. And as the long day goes by and the second night creeps on we eat our modest supper and once more resort to the bag. As we settle ourselves for the night we are conscious of the first sign of break in the gale. The wind is becoming more squally; during the furious gusts the tent flaps more madly than ever, but between whiles there is a sensible indication of peace, and we shut ourselves in with hopes that we are approaching the end of our imprisonment.

By the early hours of the morning the improvement is very marked; we are conscious that for brief spells the canvas is still, and that even in the squalls it is less violently agitated. This is the beginning of the end; the air is probably still full of flying snow-crystals, but in a few hours they will be settling and the nimbus clouds will have passed us by. When we rise at the first streaks of dawn it is to a brighter prospect; the light which penetrates the green walls of the tent is sufficient to show

that there must be a clear sky. These walls are fluttering only at rare intervals and in gentle fashion, chiefly because the wind has fallen, but partly also because they are banked high with drift snow which has caused them to sag in on every side until the inner space is narrowed by some feet. The door is completely drifted up by a heavy bank.

After rolling up the sleeping-bag the first thing to be done is to effect an exit, and this we do by lying on our backs and kicking for all we are worth at the snow-banked canvas. After a bit we can untie the door, and, still kicking, force our way out; then the shovel is found, and with its aid the drifts are soon diminished.

We drop at once into our usual camping routine, but as the cook prepares the breakfast we have time to look about us and to note the havoc wrought by the gale. The sledges are almost covered, and we know well that the boxes and tanks on them will be found partly, if not wholly, filled. Our tent is covered with ice, the sleeping-bag is filled with it, and there is not a single article of our equipment which has not had pounds added to its weight. It is a gruesome thought; the temperature is falling again, and we shall soon have the normal condition of intense cold, with an accumulation of ice which will double each separate discomfort. We realise we are in for a 'high old time,' and that the effects of this gale will be felt to the bitter end of the journey; there will be no drying, and the ice which we have gathered will remain with us throughout. However, it is no use inveighing against the inevitable, and we start to dig out our sledges, and afterwards books, instruments, and provisions are taken out and brushed, whilst the tanks and boxes in which they have reposed are freed as far as possible from the sandy deposit. Then we go back to the tent for our well-earned breakfast, and in due course step forth once more on the march.

As can well be imagined, the diaries which record the doings of a sledge party, and which are written in such adverse circumstances as I have described, do not enter into the hardships and discomforts which are inevitable to the day's work, but in the main are devoted to the special incidents of the particular day. Such references to the normal conditions as they contain are rather in the form of hasty and incomplete entries which would convey little to the outsider, though they may amply stimulate the memory of the writer, who possesses the key to the situation. It will not be difficult to understand, however, that the person who has actually been through sledging experiences will have little trouble in recalling their general nature. The daily recurrence of discomforts and hardships leaves an impression which is not easily dispelled, and his memory affords him ample material for drawing a typical picture of the sledge-traveller's daily round.

It would be impossible in describing the special incidents of our journeys always to supply the detail which would make the circumstances clear. I have therefore in this chapter endeavoured to describe what may be considered the normal experiences and environment of the spring sledging parties, and thus to provide a general background for the more varied adventures of our individual excursions. I am not conscious of colouring the picture highly—the discomforts are far too real to need imaginative treatment—nor is it conceivable that anyone would willingly face such conditions without some sufficient object to compensate for the hardships endured.

But it must be remembered that all these conditions which I have described are a result of the severe temperatures and storms of the spring. Fortunately for the sledge traveller, as the season advances, the climatic conditions become milder, and in summer the sledging life may become not only bearable but pleasant. It

has always seemed to me that scarcely sufficient stress is laid on this difference in Arctic books of travel. One is apt to overlook the fact that the conditions described in the earlier journeys have passed away during the more extended efforts, and that in some of the latter the travellers have actually suffered more from the sun and the heat than from the cold. In point of fact, summer sledging is so different from spring sledging that it might well be considered a separate employment, and therefore the description of a day's travelling in spring can convey no impression of the summer traveller's experiences, unless, of course, he is journeying on a high plateau (such as the summit of Victoria Land), where the climate is continuously severe.

In the South, as compared with the North, we were much handicapped by the late advent of our improved temperature conditions. There is generally a considerable rise in the Northern April; in May the air can be mild and pleasant, and in June it is sometimes disagreeably warm. In the South we got no marked improvement until the early part of November, which corresponds to the Northern May. December was the finest and mildest month, though the temperature rarely rose above the freezing-point, but even then we had sometimes cause to complain of the heat.

It would not be possible to describe a typical summer day's sledging, because two days were rarely alike, and so much depended on the direction in which we travelled and on the object of the journey; but it is perhaps as well to point out wherein it differed from such experiences as I have already described. In summer, of course, there was full daylight; one lived and slept and ate with the sun circling above the horizon, and the flickering candle formed no part of one's equipment. During the night one's boots had reposed near the tent: much of the damp had dried from them, and although they were frozen,

there was little difficulty in thawing them—they could be put on and secured neatly whilst the breakfast was being prepared.

On a fine day in summer the first task is to drag the sleeping-bag out into the open, to turn it inside out and support it facing the sun; by this means much of the moisture is evaporated out and much forms in tiny crystals on the hair and can be brushed away. Sometimes it is carried on top of the sledge in this way, so that the drying process may continue, but if the weather is unsettled it is thoroughly beaten and turned again before packing. Except during blizzards and cold snaps, this sleeping-bag has become a really pleasant resort. There may be a little ice under each person's body, but the greater part of the material is soft and pliable, and after a hard day's march one snuggles comfortably into its folds and is soon away in dreamland.

The cooking-things can be handled now without much difficulty, and the ends of one's fingers no longer display a row of horny blisters, though in many places they have dried and split and there are deep cuts about the nails.

We start on the march without our wind-clothes; in fact, we rarely wear them now except when it is blowing or snowing. In place of our helmets we now wear a broad-brimmed hat, for the glare of the sun is great, and with its reflection on the white snow it has already burnt us all to a deep chocolate colour; while at night we wear a simple Balaclava. Soon after the march starts we are perspiring freely; the labour is very heavy, and we are not sorry to be able to throw open our coat. We scarcely realise that the air is chill until a halt shows it is necessary to button up again. Mits are still slung around our necks, but we usually march with our hands free and yet with pleasantly pink fingers.

On coming to camp we can take things cooly—and as the march has been carried to its utmost length, we are

capable of little else. Except for the cook, no one enters the tent now until supper is ready; for the rest there is plenty to be done in thoroughly securing the tent, opening out the sleeping-bag, and spreading out damp articles to dry. The cook calls us when supper is ready, and we are not slow in answering the call. After supper we leisurely change our foot-gear and spread out the sleeping-bag, but instead of jumping into the latter at once we carry our sodden boots and stockings into the open and distribute them about the sledges, taking care to secure them with string or safety pins that no unkind gust may waft them away whilst we sleep.

After this, with the memory of supper still fresh, it is comfortable enough to sit in the sleeping-bag, smoke our pipes, write up our diaries, and stitch away at some torn garment; then, perhaps, as the chill of the air creeps in or the fatigue of the day overcomes us, we creep down into our berths and are soon asleep. If it is calm and the sun shines directly on the canvas side, it can be quite warm within the tent; sometimes we have to sleep with our heads in the open, and on rarer occasions we have even had to leave the bag and sleep on top of it.

But there are troubles in the summer travelling as well as in the spring, though they are of a somewhat different nature.

There are blizzards and winds still to be contended with; either will cover us with snow and put a stop to the drying, and we have several days of damp misery before we can recover from its effects. We leave our socks out to dry in a bright sun. The wind springs up in the night, and they are covered with drift; the sun melts this into the fabric, and in the morning, instead of dry foot-wear, we have to grapple with masses of ice. The same sun melts the snow on the tent and covers it with a sheet of ice. Though the temperature may be below freezing, snow

incautiously left in the provision tank will melt and render everything soft and sodden.

From start to finish of the march we have to wear goggles for protection against the intense glare, but we grow inexpressibly sick of these safeguards, and weary of always seeing the world through a tiny aperture. In spite of this protection, too, snow-blindness is common, and rarely a night goes by but someone needs doctoring; the solution of zinc sulphate is thawed out, and the sufferer lies flat on his back whilst a ministering companion drops the remedy into his eyes with the end of a match. It is one of those remedies which might be thought worse than the disease, for it gives the victim what he calls 'gyp,' and generally keeps him awake for the next hour or two with throbbing eyeballs.

In the spring journeys the marches had to be suited to the conditions, but in the summer we live to march; there is no excuse for dawdling in the morning now, and we are soon on the go. Hour after hour passes till the welcome halt for lunch, and then again hour after hour till the night camp is pitched. It is very toilsome work. Day after day we put forth our best efforts, but though physically fit and hard, it is impossible not to feel stale at times and to long for the hands of the watch to go faster; the number of miles to show for a long day's work seems ridiculously inadequate to the exertion expended. When camping time comes, we feel almost inclined to drop in our tracks and wish to goodness there was someone else to pitch the tent or do the cooking. The march has been arranged to absorb the maximum portion of our energy, but there is not much present satisfaction in contemplating the limp condition that results. With the most desperate desire to sit or lie down, we remember that it is our duty to fix the position, and, with a groan, plod away to the instrument box, produce theodolite, watch, and notebook, and endeavour

to collect all our faculties to start on the dreary round of observations.

But our most poignant suffering during the summer season comes to us by reason of our hunger. The spring absence was not long enough fully to develop the pangs, but now, as week follows week, we become more famished until our thoughts turn to little else but food. The effects of breakfast have passed in an hour, or at the most two, and we plod on with unsatisfied longings during the morning. Lunch has become almost an insult in its insufficiency; it is gone in a twinkling, and we gaze at the provision bag, frown at the cook, and wonder if he has not cut our allowance too fine with a misplaced ardour for saving. The end of the afternoon is sometimes really painful; tired and worn, we feel a positive gnawing in the middle and begin to doubt if supper-time will ever come.

When at length the halt is called there is no need to hurry the cook though the conversation takes a personal turn if he is clumsy with the Primus. Our sensations from the moment that the first savoury scent of cooking issues from the tent till the last drop of *hoosh* is poured down our craving throats are beyond description; they can only be imagined, and not even that by such as have not known what hunger really is. It is well to be asleep before the effects of supper wear off, but this is rarely possible, and it is always a wise precaution to haul one's belt quite tight for the night.

Summer sledging is, in fact, a grind; it is a grind because only by putting forth one's utmost can one hope to achieve success, and because a self-imposed task can be carried to whatever lengths one chooses. Although it is conducted under far less severe conditions than those of the spring journeys, it has drawbacks and difficulties of its own, which are increased in proportion to the serious nature of the effort which is being made.

At perhaps too tedious a length I have set forth the objects of sledging, the manner in which it is organised and conducted, and the difficulties with which it has to contend. I cannot conclude without calling momentary attention to it as an occupation for men, apart from the more practical results which it purports to achieve.

Sledging draws men into a closer companionship than can any other mode of life. In its light the fraud must be quickly exposed, but in its light also the true man stands out in all his natural strength.

Sledging therefore is a sure test of a man's character, and daily calls for the highest qualities of which he is possessed. Throughout my sledging experience it has been my lot to observe innumerable instances of self-sacrifice, of devotion to duty, and of cheerfulness under adversity; such qualities appeared naturally in my comrades because they were demanded by the life.

It is in considering this that perhaps the reader will see that there is a charm and fascination in the sledging life despite its hardships and trials.

CHAPTER XII

THE SPRING JOURNEYS OF 1902

Spring Sledging Plans—Start of Sledging Season—Parties Leave the Ship—Submarine Ice—Start on Southern Reconnaissance—An Inopportune Blizzard—Return to the Ship—Fresh Start—Journey to the Bluff—Difficult Travelling—Placing the Depot—Rapid Return—Report of Outbreak of Scurvy—Experiences of Western Party—Steps taken to Combat the Disease—Some Remarks on the Nature of Scurvy—Causes which may have Led to our Outbreak—Impossibility of Determining its Exact Origin—Prospects of Future South Polar Expeditions in this Respect.

> And the deed of high endeavour
> Was no more to the favoured few,
> But brain and heart were the measure
> Of what every man might do.—RENNELL RODD.

TIRED of the long winter's inaction, impatient to be away on our travels, and anxious to submit our diligent preparations to a practical test, we waited restlessly during the latter end of August 1902 for the sun to achieve a sufficient altitude to give us light for a reasonable proportion of the twenty-four hours. So ignorant were we of our surroundings, and so formidable appeared many of the obstacles which we could view from our neighbouring heights, that it seemed desirable to devote our first efforts principally to reconnaissance.

In accordance with a plan which had long been conceived, Armitage was to conduct a party to the west, and, travelling light, was to explore the region of New Harbour

and endeavour to find some route whereby the inland ice might be reached to the northward of that forbidding range of mountains which faced the ship. It was realised that he would have to cross the sea-ice and turn slightly to the north to avoid the decayed glacier tongue on which we had landed from the ship. At the same time, with the sea-ice so constantly being broken up by the heavy gales, the party would have to be extremely cautious in their movements in order to avoid all risk of being carried away on a broken floe. Yet as long as the sea-ice held firm, it would afford a smooth and easy road, possibly the only one on which the obstacles would not prove insuperable.

Royds, with another light travelling party, was to journey to the south-west. Here our lofty mountain range again fell, and though snow-covered peaks could be seen in the far distance, there appeared to be a glacier of great volume descending into the strait. Here, then, was another possibility of finding a road to the inland. All depended on what lay between, and whilst the prospect was not hopeful, it was quite possible that by turning and twisting amongst the various obstructions a clear road could be found.

To have laden either of these parties with sufficient food to make a depot for future journeys would have been to limit their ability for exploration; obviously the first step was to find the road. I had entrusted the western exploration to Armitage, and it would be for him, after the return of these parties, to decide on the best route to be taken.

I had decided in the very early winter months to undertake the southern work myself, and as every consideration seemed to point to this being the best route for the dogs, I had determined that all these animals should be commandeered for it, making the journey essentially a dog-sledging trip. For a long time I contemplated taking only one companion, thinking that two persons would be suffi-

cient to manage the animals, while the saving of weight would compensate for the extra trouble; but in considering the difficulties which might arise from the unknown nature of the route and the risk of sickness, I finally decided on increasing the number to three. Long before this my two chosen companions, Barne and Shackleton, had been training themselves for the work.

From our hills we could see two possible roads to the south. One lay outside the White Island and promised the smoother travelling, but necessitated a considerable detour. The other was more direct, and led towards the high black cape which we commonly called the Bluff; it passed between the 'White' and 'Black' Islands, and though it seemed to contain some rough places, I thought it worth exploring, on the chance of saving the longer distance.

But in making a spring journey to observe these routes it was obvious that as one or the other must eventually be taken by the main party, in either case that party must pass around the Bluff, so that it was advisable that the southern reconnaissance party should carry enough food to be able to establish a depot at the Bluff.

Besides these early efforts at clearing the routes for the main journeys, one other matter claimed our attention in the spring programme: we had still to communicate with the record at Cape Crozier. It was advisable that this should be done before the longer journeys were undertaken, but I thought it might be left until after the reconnaissance parties had returned.

As a preliminary to the commencement of the spring programme, I decided to make a shirt trip to the north with the dogs and a party of six officers and men, mainly in order to test the various forms of harness which we had on trial, and to find out whether the dogs pulled best in large or small teams; but incidentally there were many minor topographical features in this direction which we

could not see clearly from the hills, and which we now wished to make sure of.

On September 2 we started in a blizzard and camped in conditions of some discomfort; on the following day we pushed on past the Turtle Rock and found ourselves brought up by the long tongue of a glacier. Although this was but eight miles from the ship, from our hills we had only been able to make out a wavy, indistinct shadow, showing how extraordinarily limited is the distance at which one can detect ice disturbances.

This glacier tongue is worthy of a short description, because it is typical of other ice formations in the Ross Sea, and has puzzling characteristics for which, even to this day, we have not been able to account. It consisted of a thin tongue of ice, about five miles long, which shot out directly into the bay and thus into a position where the sea-ice annually formed and broke up on each side of it. It was little broader at its base than at its end, but both sides of the tongue were deeply serrated, so that a man walking along the top would find it might narrow to a quarter of a mile, or broaden out to nearly three-quarters. Moreover, thus pursuing his way along the top he would gradually rise and fall in level perhaps as much as ten or twenty feet, the outer higher parts being separated by many valleys from the inner. If the reader considers this shape, he will see that it suggests itself as an impossible form for an active ice-stream to take, and though it led directly away from the higher southern snow-slopes of Mount Erebus, one could not conceive that it had been actually formed by those snow-slopes in their present condition.

Later on we sounded around the end and for some way on each side of this glacier; we found that the ice-tongue, or at least the end of it, regularly rose and fell with the tide, and nowhere about it could we get anything but deep soundings. Now, not far to the north were some

rugged volcanic islets, showing that the bottom of the bay may be very irregular; but if some irregularity kept this long fragile tongue in position, why should it rise and fall with the tide? To all intents and purposes we seemed to have a peninsula of ice floating in the sea, and yet for year after year failing to break away from its source. For this phenomenon we could never find a reason, but for the general shape of this ice-formation I shall hope to advance an explanation in a later chapter. Before we left our winter quarters we spent a long time camped in its vicinity, and in consequence had many an argument concerning it.

On September 5 we crossed this glacier tongue and explored the islets beyond. They were of little interest, being merely masses of volcanic rubble, but as we crossed we noticed that the ice underfoot was of very recent growth; evidently the sea had been swept clear beyond the snout of the glacier quite lately. What we had seen from the hilltop latterly was no figment of our imagination, for whilst we lay snug and secure in our winter quarters the sea had been open, and probably tempestuous, within seven or eight miles of us.

On this journey we took our four sledges independently, with four dogs harnessed to each. We found that if the first team got away all right, the others did pretty well at 'follow my leader.' Sometimes there was even some competition for place, and on one occasion two competing teams gradually converged, with the natural result that when they got close enough to see what was happening it occurred to them that much the easiest way to settle the matter would be by a free fight; the teams therefore turned inwards with one accord and met with a mighty shock. In a moment there was a writhing mass of fur and teeth and an almost inextricable confusion of dog traces. Even in the short interval that elapsed before the drivers were amongst them, beating

right and left, it was possible to see that the code was observed; each dog confined his attentions to the 'enemy,' and did not attempt to attack his comrades. It was rather surprising to find even this amount of honour amongst such unscrupulous creatures.

On the afternoon of the 5th we turned homewards, and arrived on board just before dusk. Even in this short trip of four days we had gained some experience. There were evidently good reasons for not dividing the dogs into small teams. We had learnt also to distinguish between the strong and the weak, and, what was of more importance, the willing and the lazy; and we saw that we should require a good deal of alteration in our harness and in some of the fittings of our sledges.

For the few days which now intervened before my party started for the south, I call on my diary once again:

'*September* 5.—Armitage returned to-night with a party of twelve. They have fetched in the depot which we left out last year; it was no use having provisions out at such a short distance, but it is rather amusing to think that this deliberately wipes out the only result of our autumn trip. This party camped at the depot last night and dragged it right in to-day. It is only about eight or nine miles, but I calculate they must have been dragging nearly 280 lbs. per man, and they are all terribly out of condition. As a result, when they arrived at the ship they were positively cooked, and to-night they are fighting their battles over again, and the conversation is highly entertaining. They all agree that if sledging is always going to be like this, there will be reason deeply to deplore the fact that they ever left a comfortable home and came to sea.'

'*September* 10.—Royds and Koettlitz started away to-day with Evans, Quarterly, Lashly, and Wild. The party looked very workmanlike, and one could see at a

glance the vast improvement that has been made since last year. The sledges were uniformly packed. Everything was in its right place and ready to hand, and all looked neat and business-like. One shudders now to think of the slovenly manner in which we conducted things last autumn; at any rate, here is a first result of the care and attention of the winter.

'To-night it has been bright and clear, and we saw in more perfect form a phenomenon which we have occasionally witnessed before. High in the northern sky were some light, wavy cirrus clouds, carrying the most perfect prismatic colouring. They seemed like twisted fragments of a rainbow, and were very beautiful against the pale blue sky; we watched until the lights paled with the dying sun.'

'*September* 11.—This morning Armitage left for the west. He takes one other officer, Ferrar, and four men; Cross, Scott, Walker, and Heald. The party introduced the novelty of systematically pulling on ski, at which they have been practising lately, much to the amusement of the onlookers. There is not much difficulty in the pulling after the first start; the great thing is to swing together and keep in perfect time. I am inclined to reserve my opinion of the innovation. The "Terror" trip may have proved their use in soft snow, but a hard surface is a different matter. The men seem rather in their favour, but that is natural with any novelty, and however this party may have got on later in the day, their starting pace was very slow.

'I was thinking to-day as I looked up at our masts and yards that my preconceived notion of a polar winter always pictured them covered with snow, and perhaps with long icicles depending; as a matter of fact, they have been generally quite free from snow, and throughout the long night nearly always looked black and grim. But, curiously enough, this afternoon, when ice-crystals

were falling, they became frosted over, though a strong wind was blowing; and, oddly too, the wind seemed to have quite a different note as it blew through the frosted rigging.

'*September* 12.—Hodgson has made quite a discovery; he finds that his ropes and nets whilst under water become coated with ice-crystals. He tells me he noticed this fact some time ago, and that the effect has been gradually growing, presumably as the water has become colder. This morning I went out to see some lines which he was hauling up. It is certainly a very curious phenomenon, and one that is difficult to describe; one small line only an inch in circumference came up covered with a cylinder of flaky ice nearly a foot in diameter, and this cylinder extended five or six fathoms below the surface, after which it gradually dwindled away. The formation is very delicate, and in the flaky structure the axes of the leaves are at right angles to the rope, whilst their planes are inclined and intersect at the angle of crystallisation, 60°. The whole thing looks like some beautiful lace fabric, and held up to the light one can see through it the most gorgeous prismatic colouring. It falls to pieces at a touch, and each leaf can be split to the thinnest layers. Shackleton took some photographs and Wilson attemptd a sketch, but I doubt if either will produce a picture which is anything like the delicate original.

'Somewhat similar crystals are formed on the tow-nets, but here each minute fibre which stands out from the fabric has formed a nucleus for the ice to form, and the net, with its hanging icicles, looks like nothing so much as an old-time candelabrum with crystal pendants. We do not know quite how to account for these formations; our thermometer show the temperature of the water as something below its freezing-point, but I do not know that they are very reliable for such small differences.

In any case, I do not know of this sort of thing having been recorded elsewhere.'

It has been since explained that these crystals were probably due to the super-cooling of the sea, and that with the sea in this condition ice will only form about such nuclei as were afforded by the ropes and the nets, just as a supersaturated solution can be made to crystallise in much the same manner in a simple laboratory experiment. In this light it would be natural enough that the effect should increase as the water grew colder towards the spring, and it is interesting to note that Hodgson found that at one time these crystals formed as deep as seventeen fathoms below the surface.

Owing to some delay in making fresh harness for our dogs, and in rearranging the manner of their pulling, followed by the intervention of a most tantalising blizzard, it was not until September 17 that I was able to make a start on the southern reconnaissance journey. On the morning of that day we got away fairly early, my two comrades being Barne and Shackleton. We had with us only thirteen dogs, divided into two teams. The sledges carried food for a fortnight for all concerned, together with a quantity of stores to form a depot, the whole giving a load of about 90 lbs. per dog. My diary for this journey continues:

'Left the ship at 9 A.M., dogs at first pulling well. Bright clear sky with sunshine, fluctuating temperature. Came to the old ice-rise (about fifteen feet in height, four miles south of the ship). 1.15, camped for lunch, having covered about ten miles; wind turned to east, very cold, thermometer $-43°$, haze near surface and now slight wind-drift. Land mostly obscured, but high points giving general direction. Dogs find loads heavy, but pulling fairly well; a few cases of sore feet; made good evolution of packing tent, and away again. Saw magnificent parhelion showing prismatic colours on each

side from horizon to about 20° of altitude. About 3.30 observed black specks far over the snow to the right front; proved to be Royds' party; soon came up with them. Heard they had had a very rough time, low temperatures with much wind. They had found road to the S.W. quite impossible, strewn with enormous boulders and all sorts of ice obstructions; failing to pass to the north of Black Island, they had tried to the south, but without much result. It was far too cold to stop and discuss details. One gathers that there is no hope of making a long journey in this direction, which is a nuisance; the rest must remain till we get back. After about twenty minutes we parted, Royds steering for ship, mist still obscuring land; head wind sprang up, very biting (temperature −45°), frost-bites coming rather fast, dogs wearying. About 5.30 decided to camp, none too soon; excellent supper; have turned my finneskoes inside out for sleeping in, to make trial of this plan. Struggled into sleeping-bags about 7.30, where now writing. Have travelled 12½ geographical miles (14¼ statute); last temperature reading −48°, keen wind from S.E.'

From the above extract it will be seen that the sledging diary gives a very laconic record of the day's events. It is drafted somewhat after the fashion of a telegram, where each word has to be considered—and, indeed, on such occasions, if one does not pay in cash, one pays in kind for superfluous verbiage. It is therefore from such a daily record as this that the sledge-traveller is able to reconstruct the history of his wanderings in very severe weather, though of course when the temperatures rise and his hand is no longer paralysed with the cold, he is inclined to amplify his sentences and enlarge on his ideas.

But on this occasion with the above entry my sledge diary comes to an abrupt conclusion, as, contrary to expectation, the next time I took up my pen to write

I was once more comfortably seated in my cabin on board the ship.

'*September* 19.— . . . I suppose it was our want of condition that made us all so very exhausted on Wednesday night (17th), and that it was in consequence of this that we did not heap enough snow on the skirting of our tent and that we became so utterly unconscious of the change that was taking place in the weather. At any rate, I remember nothing until Thursday morning, when I woke up to find myself in the open. At first, as I lifted the flap of my sleeping bag, I could not think what had happened. I gazed forth on a white sheet of drifting snow, with no sign of the tent or my companions. For a moment I wondered what in the world it could mean, but the lashing of the snow in my face very quickly awoke me to full consciousness, and I sat up to find that in some extraordinary way I had rolled out of the tent. A violent gale was raging and the air was filled with thick, blinding snow. I could only just make out the tent, though it was flapping wildly across the foot of my bag; it was evident that it still stood upright, and that the sooner I was in its shelter the better. I started to wriggle in, bag and all, and at length got beneath it, and could see more clearly what had happened. The bamboos were still secure and the skirting of the tent was still held down on the weather side, but to leeward the snow had been flung off it, and on this side the canvas was flapping loosely, leaving an interval beneath through which I must have rolled.

'I do not think this state of things can have obtained for long, as Barne and Shackleton had only just realised it, but of course by this time the snow was whirling as freely inside the tent as without, our sleeping-bags were covered, and we ourselves were powdered with it. The tent was straining so madly at what remained of its securing that evidently something must be done at once

to prevent its flying away altogether. With freezing fingers we gripped the skirting and gradually pulled it inwards, and, half sitting on it, half grasping it, endeavoured to hold it against the wild efforts of the storm whilst we discussed ways and means. Discussion led us nowhere; to have attempted to secure the tent properly in such weather would have been useless, even to venture outside would be dangerous, whilst we felt that if we once let go it might be good-bye to our tent.

'As we clung on in this horrid position the skirt would gradually pull out beneath us and suddenly fly out, flapping wildly again, and we were forced to get a fresh hold and lever ourselves over it once more. Without exception this was the most miserable day I have ever spent; our sleeping-bags became more and more snow-filled until we were lying in masses of chilling slush; our mits were filled in a similar manner, the slippery canvas would pull through their grasp, one was obliged to bare one's fingers to haul it in again, and one could not possibly get through such a job without having some of them frost-bitten.

'Thus we remained for hour after hour, grimly hanging on and warning each other of frost-bitten features. We waited longingly for a lull, but the first did not come until midday. Then we made a desperate effort to get to the sledges; my companions ventured out whilst I clung to the canvas; they succeeded in getting hold of two provision bags, and returned with a rush. Their absence was certainly not longer than two minutes, yet both faces were quite white with frost-bite when they came in, and it was several moments before they regained their natural colour.

'In the afternoon we were beginning to feel a bit spent, and realising that something more must be done, we waited for a lull and again ventured out. This time we managed to get hold of two heavy bags of biscuit.

It was not until 6 P.M. that by continued exertions we had so far conquered matters as to have no further need to hold the tent except with the weight of our sleeping-bags, and for the first time our arms were released for other purposes. An inspection of hands showed that we had all been pretty badly frost-bitten, but the worst was poor Barne, whose fingers have never recovered from the accident of last year, when he so nearly lost them. To have hung on to the tent through all those hours must have been positive agony to him, yet he never uttered a word of complaint.

'We were now able to wriggle down a little further into our wretchedly wet bags and to eat some cold pemmican and chocolate, whilst we waited for the storm to pass, with a growing stiffness in the backs of our necks from the never-ceasing flap of the canvas against which we leaned. More miserable conditions could scarce be imagined.

'Throughout the day we had not been able to spare a thought for the dogs, but we imagined that they would long ere this have been covered with snow, and therefore comfortable enough; but about this time we heard a sad whimpering at our door and found poor "Brownie," a very miserable shivering object, whining piteously with cramp, so he was allowed to pass the night inside, where he seemed to make himself very happy, especially when he got some of our supper. The rest never uttered a sound till we roused them out of their soft nests on the following morning.

'As darkness descended on us again we lay in our bags with the snow four inches thick on the floorcloth about us, and our clothes becoming more and more saturated with moisture; but at seven o'clock the snow ceased to fall, at nine the wind came in violent squalls, and at ten it was evident that the worst of the storm was passed. Stiff and sore, we set about making our

position more comfortable, and then endeavoured to snatch a few hours' sleep.

'This morning we roused out at 3 A.M., cooked our first meal for thirty hours, and briefly discussed the situation. Our sleeping-bags and clothes were literally covered with ice, and we could only push on under the most abject discomfort; by returning to the ship we should only lose one day's march and everything could be dried afresh. We did not hesitate long before deciding to return, and after a grand hot meal of cocoa and pemmican we gradually collected our scattered belongings and packed them on the sledges.

'As we started on the homeward march, the sun was rising in great magnificence, lighting the east with brilliant red and bathing the western hills in the softest pink. It was hard to think that a gale had raged here but a few hours before.

'I think this must have been the coldest blizzard we have had; our minimum thermometer was drifted up with snow and stood at $-43°$, but possibly this recorded a temperature prior to the blizzard. Whilst it was blowing we could not reach the thermometer, but judging by temperatures taken elsewhere, and our own sensations, I do not think it could have risen above $-30°$ throughout, which is most exceptional with a strong wind. When we got up this morning the spirit column stood below $-50°$, and Royds, five miles to the north, recorded $-53°$. The effect of such a temperature on our wet clothing may be imagined. I shall remember the condition of my trousers for a long while; they might have been cut out of sheet iron. It was some time before I could walk with any sort of ease, and even when we reached the ship I was conscious of carrying an armour plate behind me.

'So here we all are, back again, having accomplished nothing except the acquisition of wisdom. It will

certainly be a very long time before I go to sleep again in a tent which is not properly secured.

'Royds and his party weathered the gale five miles north of us; they had no trouble at all with their tent, thanks to plenty of snow on the skirt. They have had a severe trip, but are all pretty fit. It appears they came to very rough ground to the north of Black Island, and advanced for some distance by portage, but finding little improvement they turned back. At one place a gust of wind swept one of their single sleeping-bags away; luckily, there was a three-man sleeping-bag, and they managed to squeeze four people into that, but all four agree that such a tight squeeze banished all chance of sleep. Two days later they found the missing bag some four miles from the spot at which it had been lost. Koettlitz thinks that it will be quite possible to circumnavigate the Black Island in spite of the rough ground, so I have given him permission to try.

'I hear that the late gale was very severely felt in the ship: the temperature fell to −32°, no work could be done outside on Thursday, the stove pipes were bent, and heavy planks were swept off the skid beams by the wind.'

'*September* 23.— . . . We are preparing to be off again, but some fatality seems to ensure bad weather on the date fixed for our departure. Barne's fingers suffered so severely in our recent adventure that he has had to be replaced by the boatswain, Feather. The latter has worked so splendidly all through, and has taken such a keen interest in every detail of the sledging, that I am glad to give him the chance of accompanying us.'

Early on September 24 we got away; travelling with light sledges, we reached our desolation camp, fifteen miles to the south, before we called a halt, and, increasing our loads to full weights, camped for the night at a distance of twenty-three miles from the ship. On

the following day we were forced to face a bitter southerly wind with drift and a temperature of −30°. After a few miles the dogs refused duty, and we were obliged to camp.

Proceeding later, when the wind had dropped somewhat, we found ourselves climbing a stiff incline between the two islands, and we had risen at least 180 feet before we reached the top. Across the slope there ran two or three well-marked cracks which I think can only have been tide cracks, and which went to show that the ice-sheet over which we had been travelling was afloat. On the other side of this crest there was a slight descent, but not for much more than fifty feet, after which the surface stretched horizontally ahead of us and was undoubtedly at about the general level of the barrier. I came to the conclusion that the two islands were joined, at least by a shallow bank, if not by land above the water level, and that the barrier sheet was over-riding this and pouring slowly into the sea to the north.

On the 26th we had a beautifully clear day, and pushed on towards the Bluff, which now loomed high above us. We were much struck by the fact that all the wind-furrows in this region lay in a south-westerly direction, showing that the prevalent wind is from that quarter, although at the ship we had known little but south-easterly winds. When we camped at the close of this day, after a fifteen mile march, we were within a short distance of the north side of the Bluff, and already there were signs of obstacles ahead. Here and there in the snow surface rose a dome-shaped mound of blue ice, and beyond these we could see little heaps of rubble. It behoved us to be cautious if we would avoid injury to our sledge-runners.

The ice-mounds deserve notice; they are a very typical form of disturbance on the surface of any glacier, but are probably rarely so well developed as we saw them. They

are caused by surface melting, the water freezing again below the ice, when the expansion on regelation gradually lifts the surface. To stand amongst a number of these domes is very impressive, especially when they are uniformly rounded. They rise but a short distance before they are cracked in all directions on top, and the cracks gradually open into broad, deep fissures. We found domes as high as seven and eight feet in this region, and saw mounds which in attempting to rise further had lost the dome form and stood up like irregular-shaped craters. It was on the surface of one of these, far from the land, that Mr. Ferrar found a large quantity of crystals of sodium or magnesium sulphate. I am not chemist enough to suggest a reason.

'*September* 27.—Started with promise of a fine day, temperature −46°. Soon after, the sky became overcast and the temperature rose. The travelling changed altogether in character; the ice-mounds grew thicker, and reached a height of eight to ten feet, with broad, ugly cracks all over them. Later they seemed to assemble in ridges running more or less east and west, and hence right across our tracks; the dogs could make no show of crossing them, so we had to turn outwards in hopes of getting better travelling. Instead of this it got worse, and after lunch we passed into a turmoil of torn and twisted ice, forming ranges of hillocks twenty and thirty feet high, sometimes rounded on top and sometimes rising in sharp ridges. The higher parts were swept clear of snow and showed bare blue ice, whilst in the hollows the snow lay in high, hard *sastrugi;* the contrast was plain even in a bad light.

'Travelling now became a regular scramble up hill and down dale. The dogs did not appreciate it at all; they had to be helped up the stiff bits, and when the sledge came skidding down the descents they almost howled with terror. The wind has increased to half a gale from the

S.S.W., but it is astonishingly warm; the temperature has risen above zero, so we have built a good snow-wall to protect our tents.

'*September* 28.—Awoke to find a gale with heavy drift, but our tent very snug and comfortable. The temperature has gone up to + 7°, and our sleeping-bags are pleasantly warm and comfortable. The most extraordinary thing is that in spite of the flying snow outside our things are actually drying, and for the first time in our experience we find ourselves in a weather-bound camp becoming drier instead of wetter. Not being at all cold, we find time to be bored, and, by ill-luck, no one thought of bringing a book or a pack of cards; but who could suppose that it would be possible to use them during a spring journey? We could really get on now but for the light, but that is so bad that to move over this rough country would be a great risk.

'*September* 29.—Wind dropped in night, and was succeeded by flat calm with rapidly falling temperature. We were away by 7 A.M., but shortly after a fresh bank of cloud came up from the south, with more wind and drift. We were all too impatient to stop again, so pushed on, myself leading, with orders to the two teams to follow rigidly in my wake, in spite of any turns and twists I might make.

'Notwithstanding the bad light I could see the bridged crevasses where they ran across the bare ice surface by slight differences in shade, and where they dived into the valleys, though I could not see them, I found that the bridges were strong enough to bear. I stuck as much as possible to the snowy patches, but this necessitated a very irregular course, and the dogs invariably tried to cut corners. In this manner we proceeded for some time, but suddenly I heard a shout behind, and, looking round, to my horror saw that the boatswain had disappeared; there stood the dog-team and sledges, but no leader.

I hurried back and saw that the trace disappeared down a formidable crevasse, and to my relief the boatswain was at the end of the trace.

'I soon hauled him up and inquired if he was hurt, to which, being a man of few words, his only reply was, "D——n the dog!" from which I gathered that "Nigger" had tried to cut a corner and so pulled his leader at the wrong moment, and, incidentally, that the boatswain wasn't much hurt. This evening the boatswain has shown me his harness; one strand was cut clean through where it fell across the ice-edge. Altogether he had a pretty close call.

'After this accident we joined our dog-teams, and, loath to give up the march, pushed on again. About half an hour later there was another shout, and, looking round, I found this time that it was not a man, but a sledge, that had disappeared. It was the last of the four, and I found it hanging vertically up and down in an ugly-looking chasm. To the credit of our packing, although it had fallen with a jerk into this uncomfortable position, not a single thing had come off. It was too heavy for us to haul up as it was, so, after some consultation, our indefatigable boatswain suggested that he should be let down to unpack it. He was therefore slung with one end of our Alpine rope, whilst the other was used for hauling up the various packages. It must have been a mighty cold job, but at last all the load was got up, and the lightened sledge soon followed. After getting everything in order again we found that we had sustained no greater damage than a broken ski.

'After this incident we thought it would be wise to treat these numerous crevasses with more respect, so on proceeding we roped ourselves together, and whilst I went ahead the boatswain led the dog-team and Shackleton brought up the rear to look after things in general. But we had not gone far like this when the light became

thoroughly bad ; we could see nothing at all under foot, and have been obliged to camp early. The effect of this light on our surroundings is very curious, making everything appear of gigantic size ; the smallest wind-furrow looms up like a heavy bank, and the larger ice hillocks look like ranges of high mountains.'

Looking back on this day, I cannot but think our procedure was extremely rash. I have not the least doubt now that this region was a very dangerous one, and the fact that we essayed to cross it in this light-hearted fashion can only be ascribed to our ignorance. With us, I am afraid, there were not a few occasions when one might have applied the proverb that 'Fools rush in where angels fear to tread.'

The bad light to which I have referred was a very constant source of trouble to us on our travels. It came when the sky—as was very usual—was completely overcast with a uniform pall of stratus cloud ; under such a sky there would only be diffused light, and no direct rays to cast a shadow. It can be easily understood that on a snow surface the only thing that can indicate an inequality is shadow ; consequently on these grey days it was impossible, within limits, to see what was coming next. Bad light does not, therefore, mean insufficiency of light, because on such occasions one could see dark objects at a long distance, and there was quite enough light both outside and inside the tent for all camping purposes.

'*September* 29 (*continued*).— . . . After lunch the sun peeped through the cloudy mantle, and with some difficulty we managed to push out a mile or two, when the undulations and upheavals of ice gradually disappeared, though the crevasses remained. The broader ones were safe to cross, being filled with snow, except at the edges, where a leg was likely to disappear with a false step. This seems to show that they are ever widening. The dangerous crevasses are those from three to four feet in

width, as they are covered only with light snow-bridges, which, when broken away, disclose chasms between perpendicular blue ice-walls of unknown depth. These walls are crusted with branching growths of ice-crystals, very beautiful in form, but which prevent one from seeing more than a few fathoms down.

'To-night when we camped I warmed a thermometer, ran up its indicator and lowered it at the end of our Alpine rope to a depth of sixteen fathoms; on hauling it up I found both spirit and indicator stood at $-10°$, so I imagine this to be about the mean temperature of the ice masses in this region.

'When we halted to-night our dog-trace lay across one of these crevasses, and little "Kid" promptly coiled himself down on the middle of the snow-bridge; had he been allowed to remain he would certainly have melted himself through in an hour or two, and would have become a very surprised dog. Luckily, we saw his position, and rescued him in time.'

'*September* 30.—Starting at 7.15, and still steering east, we soon passed out of the region of crevasses and turned to the south. The weather was brilliant, the sun shone forth in a cloudless sky, and the temperature was exceptionally high at $-20°$. At lunch we were about ten miles east of the extremity of the Bluff, and the scene was very impressive. Far to the north, clothed in soft white folds of snow, lay the imposing mass of Erebus and Terror; to the north-west towered Mount Discovery and the Western Range, whilst behind us also lay the various islands and foothills on which we have gazed throughout the winter. To the west we could see that the Bluff ended abruptly, being but a long peninsula thrust out into the great ice-sheet. Beyond the Bluff our eyes rested searchingly on the new country that rose above our snowy horizon. It seemed to stretch in isolated masses ever increasing in distance; but beyond the fact that the

coast curves sharply away to the west we could make little of it.

'But the most impressive fact of all was that from this new western land through the south, through the east, and away to the slopes of Terror, there stretched an unbroken horizon line, and as the eye ranged through this immense arc and met nothing but the level snow-carpet below and the cloudless sky above, one seemed to realise an almost limitless possibility to the extent of the great snow-plain on which we travel.

'Hope of finding land beyond the Bluff to which we could advance our depot was now at an end, and this afternoon we steered south-west to close the Bluff and to look for landmarks. An excellent line was at length suggested by Shackleton, who, pointing to a small sharp crater on the end of the Bluff, proposed that we should bring it in line with the sharp cone of Mount Discovery. This was done, and to-night we are encamped on the line and about five or six miles from the land. One has but to walk a hundred yards either way to throw the alignment off, so that there should be little difficulty in finding any stores we may leave here provided the weather is clear. We have just been gazing with curious eyes on the road to the south. We have passed out of the region of high snow-furrows, and it seems probable that even those which we have would be lost as one advances to the south. One conceives a plain with the surface growing smoother and possibly softer; but what will it be like to tramp on, day after day and week after week, over such a plain?'

'*October* 1.— . . . We made our depot this morning, leaving six weeks' provisions for our men and 150 lbs. of dog-food; the whole was marked with a large black flag, and I took careful angles with a prismatic compass to all the points I could see, after which we packed up our traps and faced homewards. The dogs knew at once what was meant, and there is no longer any need to drive them. The

weather has been overcast, with a heavy deposition of snow-crystals; but we have already covered several miles on the homeward track, steering to pass outside the White Island to see how the route promises in that direction.'

On our homeward march we went for all we were worth; the weather was persistently overcast, but this kept the temperature above $-30°$ though it brought a continuous fall of very light powdery snow to add to the friction of the runners. Underneath this powdery snow the surface was in good condition, having been swept very hard with the wind, but the loose crystals seemed to cling badly to the metal runners.

'*October* 3.—Got away at seven again; mist as thick as a hedge, so steered in towards the island; stumbled on rocks at about ten and gained some idea of position. Evidently passing over a slope succeeded by some ridges, a few crevasses, and some clear blue ice. Guessed by this we must have passed the corner of the island and steered for the ship. At 12.30 passed clear of broken surface, and camped for lunch at one o'clock. After tea, cheese, and jam, prepared to start, and found fog had lifted in rear showing island at our back. In afternoon were able to steer by sun, though still very thick ahead; suddenly Erebus appeared above fog, and ten minutes later we found ourselves within a mile of Observation Hill and going directly for it. The tired dogs set up a yap of delight and sprang forward with fresh energy, and soon we were home.

'We have covered eighty-five statute miles in less than three days, which is not bad going, especially as we have almost had to feel our way along. However, there is no longer a doubt that our road to the south should lie outside, and not inside, the White Island.

'I did not realise that the ship could be such a delightful place as I have found it to-night; the sense of having done

what one wanted to do, and the knowledge that we have a far clearer problem before us in the south, have much to do with one's feelings of satisfaction, but it is the actual physical comfort of everything that affects one most; a bath and a change into warm dry clothing have worked wonders. The knowledge that one can sit at ease in warmth and comfort, without being swathed to the chin in clothing, is an immense relief, and the prospect of creeping into a bed without the usual accompaniment of ice is an even greater one; but the greatest delight of all is to possess the sledging appetite in the midst of plenty.'

The joy of this possession was beyond description, and the feats of food-consumption which were performed by the possessors might well be beyond ordinary belief. For many days after we returned from our sledging trips we retained a hunger which it seemed impossible to satisfy. The ordinary frugal meals served at our table seemed to us to be heaven-sent feasts; at each meal one partook ravenously of everything, and though one ate to repletion, half-an-hour later one would be searching for bread and butter and chocolate. For the first few days, when this sledging appetite was keenest, the returned traveller would demand supper to succeed the more solid dinner; he would wake in the night to devour a stick of chocolate or to forage for better fare in the pantry; and he could be seen glancing anxiously at the clock a full hour before each meal. It seemed almost worth going a sledge journey to experience the delight of satisfying such a hunger.

'*October* 3 (*continued*).— . . . At dinner to-night I felt especially pleased with myself and the world in general. Armitage and Koettlitz had returned from their journeys, and were able to give a rough outline of their movements, and altogether our meal went very merrily; nor was it till towards the end that I had a suspicion that something was being kept back: about one or two members there

seemed to be a sort of unnatural restraint, and I didn't know what to make of it.

'So after dinner I called Armitage into my cabin and asked him what was the trouble. He looked very grave and said that he had not meant to worry me until the morning, but the fact was there had been an outbreak of scurvy. This was indeed a shock! At one blow it upset all one's sense of peace and comfort. Of course one could not allow it to rest at that, so the whole story had to be told. It is not a pleasant thing to go to bed on, and I do not feel like writing it to-night; possibly also things may look brighter in the morning when one is not so "done."'

'*October* 4.— . . . The history of our outbreak of scurvy is more or less contained in the history of Armitage's journey, into which I have been therefore with some detail. It appears that after leaving the ship on September 11, the party made a pretty straight line for the end of the decayed glacier tongue in the middle of the strait. Their progress was not very rapid, as they stuck as closely as possible to the old worn ice for the sake of safety. Even as it was, this course took them within a mile of the open water. They reached the glacier snout on the 13th, and camped securely on it. The ice beyond the snout, and from thence to the westward, had only recently been formed; there was practically no snow on it, and its dark colour was only relieved by the briny ice-flowers.

'Apart from the danger of this ice being broken up again, it was impossible to camp on it, as no snow could have been obtained for cooking or for securing the tents; the party were obliged, therefore, to skirt the edge of older ice to the south, and this added to the length of the journey. During this time the open water was never far from them, and, besides numerous seals and penguins, they constantly saw whales (probably killer whales) spouting in the offing. On the night of the 16th they

camped on the slope of the foothills of the mainland; not far to the north of them was the New Harbour, whilst immediately to the south was an immense pile of morainic material which they have called the "Eskers." This it is that looks like a small range of hills from the heights above us and which we have often been puzzled to account for.'

I should add that this formation was really an old lateral moraine, and, as we soon discovered, it was quite wrongfully called the Eskers, a name properly given to deposits formed by glacial streams; but a name once given is a very hard thing to change, and after this first journey no one could be brought to refer to this formation otherwise than as the Eskers, and I have no doubt this name crops up many times in my journal in spite of my knowledge of the error.

'On the 17th they hauled their sledges to a height of 500 feet up the snow-slope and pitched a camp there, with the intention of making excursions from it. Since their start from the ship the weather had been very changeable, and they had experienced a great deal of wind with low temperatures. On some days the wind had been so violent that they had been forced to stop in their tents; such a day was the 18th, but on the 19th five of the party left the camp, and crossed the long snow-slope which bounds our view on the south side of New Harbour. From this they could get a good view of the valley beyond, and saw that it cut deeply into the mountain range and contained a huge glacier. Looking up the valley, they were faced by a high single-peaked mountain, and the glacier appeared to turn to the right as it reached its foot. As far as the upper parts of the glacier were concerned, there appeared to be good travelling, but from the foot of the descent, for some seven miles outwards, they looked down upon a confusion of ice which they had never seen equalled. Armitage describes huge masses broken and

fissured and standing nearly fifty feet above the general level. Interspersed with the ice are vast heaps of morainic material, and the whole forms a chaotic obstruction across which he thinks it is impossible that sledges can be taken.

'Skirting along this rough disturbance they advanced up the valley, but it was now getting towards midnight and some of the party were beginning to tire from the long exposure. Mr. Ferrar and Heald had been sent back some hours before, and now the remaining two turned also. Armitage says that on his return he came across the tracks of two people, which he followed, expecting them to lead to the camp, but later discovering that they certainly did not he became very alarmed, thinking that Ferrar and Heald had missed their way. Still following these tracks, he now and again came across a mark in the snow as though one of the two had been obliged to take frequent rests. At last, to his relief, the tracks suddenly turned about and now led directly towards the camp, which he eventually reached at 5 A.M., after an absence of twenty hours.

'He found that Ferrar and Heald had made the tracks he had seen, and that by losing their way they had been three hours late in arriving back; furthermore, that on the way Ferrar had collapesd several times and on each occasion had been overcome by an irresistible desire to sleep. He was only kept awake by the persistence of his companion, Heald, who, although almost worn out himself, realised the danger they were running and showed the greatest determination in pushing on. As the temperature at the time was $-45°$, there seems little doubt that Ferrar practically owes his life to his companion's exertions.

'Hoping to find out more about the New Harbour glacier, on the 21st they dragged their sledges over a rise of 1,000 feet towards its entrance. They had great difficulty with the steep descents, but eventually made their

way down safely. A second examination of this region did not give any more promising results than the first, and Armitage came to the conclusion that to attempt to reach the mainland by this route was impracticable. On the 22nd they started their homeward journey, skirting now around the base of the long snow-slope on recently formed sea-ice. It was about this time that, in cogitating over recent events in the journey, Armitage began to suspect that there was something wrong with the health of the party. Several men had complained of sprains and bruises which seemed to give pain without much cause; he thought, too, that they tired more easily than strong men should have done, and it seemed especially curious that such an active officer as Ferrar should have collapsed under a hard day's work. The thought of scurvy, however, did not enter the leader's head, and he was inclined to put the troubles down to the horrible weather conditions and to the fact that so few of them had been able to sleep.

'As the party gradually made their way back to the ship, things got worse and his alarm grew. The light sledges hung heavily on the men, and though there were no complaints, several seemed only to keep themselves going with an effort. The evening of the 25th found them within a few miles of the ship, and in such a crippled state that Armitage thought it wiser to struggle right on till they reached her, which they did at 6 A.M. on the 26th.

'The result of Wilson's medical examination of this party on their return has been handed to me; the gist of it is that Heald, Mr. Ferrar and Cross have very badly swollen legs, whilst Heald's are discoloured as well. Heald and Cross have also swollen and spongy gums. The remainder of the party seem fairly well, but not above suspicion; Walker's ankles are slightly swollen.

'Of course there is no good blinking our eyes to the fact that this is neither more nor less than scurvy, but

whence it has come, or why it has come with all the precautions that have been taken, is beyond our ability to explain. The evil having come, the great thing now is to banish it. In my absence, Armitage, in consultation with the doctors, has already taken steps to remedy matters by serving out fresh meat regularly and by increasing the allowance of bottled fruits, and he has done an even greater service by taking the cook in hand. I don't know whether he threatened to hang him at the yardarm or used more persuasive measures, but, whatever it was, there is a marked improvement in the cooking.

'Koettlitz has only been back a few days from his second trip, but has made an examination of everyone on board. He tells me there are signs of scurvy in a good many, but in most cases it is only the merest indication, and probably we should not have known anything about it had it not been for this searching examination. The worst cases are those which I have named above, and they, as well as the rest, are improving by leaps and bounds—in fact the disease is vanishing rapidly. He confesses himself unable to suggest any cause for the outbreak.

'The signs of improvement are hopeful, and there seems little doubt that we shall banish the disease; but one cannot be too cautious, and we must lay ourselves out to make arrangements which will not only banish it for the present, but will prevent all chance of its recurrence in the future.

'Royds was to have started for the "Record" at Cape Crozier on the 2nd, but deferred his departure till my return. I saw no reason for delaying further, and the doctors report his party to be in first-rate condition, so they went off this morning. With the leader go Skelton, Lashly, Evans, Quartley, and Wild—practically the same party that went to the south-west, so they ought to know what they are up to. Though there is not much else but

scurvy in my thoughts just at present, the great thing is to pretend that there is nothing to be alarmed at.'

'*October* 15.—The determination to have everything above suspicion, and not to give our dread enemy another chance to break out, has kept all hands pretty busy of late.

'With the idea of giving everyone on the mess-deck a change of air in turn, we have built up a space in the main hut by packing cases around the stove. In this space each mess are to live for a week; they have breakfast and dinner on board, but are allowed to cook their supper in the hut. The present occupants enjoy this sort of picnic-life immensely.

'We have had a thorough clearance of the holds, disinfected the bilges, whitewashed the sides, and generally made them sweet and clean.

'As a next step I tackled the clothes and hammocks. One knows how easily garments collect, and especially under such conditions as ours; however, they have all been cleared out now, except those actually in use. The hammocks and bedding I found quite dry and comfortable, but we have had them all thoroughly aired. We have cleared all the deck-lights so as to get more daylight below, and we have scrubbed the decks and cleaned out all the holes and corners until everything is as clean as a new pin. I am bound to confess there was no very radical change in all this; we found very little dirt, and our outbreak cannot possibly have come from insanitary conditions of living; our men are far too much alive to their own comfort for that. But now we do everything for the safe side, and from the conviction that one cannot be too careful.

'We have had great difficulties in trying to live on fresh meat alone, as our stock of seal-meat had run short. It is not easy to supply so large a company; a large seal barely lasts two days at the present rate of consumption. Just as our stock ran out, one or two seals happened to

come up on the ice close to the ship, and these kept us going until, at Wilson's suggestion, we organised a large seal-killing party to go further afield. This party, consisting of Barne, Wilson, and four men, girt about with knives and other murderous implements, journeyed away to the north with all the dogs on Thursday (9th); they camped under the glacier tongue, weathered a blizzard on the following day, and started their operations on Saturday. After a long and hard day's work, they started homewards, and arrived here on Sunday morning with over a thousand pounds of meat, and having left a large quantity ready to be brought in.

'They report that the seals are plentiful near the glacier, and that there is also a colony below Castle Rock, not more than three miles from the ship; we ought to have little trouble, therefore, in keeping up our supply in future.

'On Monday I was able to give the satisfactory order that no tinned meat of any description should be issued, and one may reasonably hope that this order can be observed throughout the remainder of our stay in these regions.

'Regular outdoor exercise is the only other circumstance that can affect our physical well-being, and with regard to that I am glad to say there has been no need to issue an order. There is a great deal of outdoor work, and every evening after tea the men either go for long ski runs or walks, or play football. As for the spirits of our party, they have never been cast down for a single minute; with the daylight and the increased activity there has been more chaff and laughter than ever, and certainly no one who walked into the living-quarters at night would guess that we were in the act of dispelling a very dreaded disease. To whichever or to what combination of the steps we have taken this is due, it is impossible to say, but the fact remains that within a fortnight of the out-

break there is scarcely a sign of it remaining, and certainly all cause for anxiety has vanished. Heald's is the only case that hung at all, and since fomentations have been applied to his legs he also has made rapid strides towards recovery, and is now able to get about once more. Cross's recovery was so rapid that he was able to join the seal-killing party last week.

'Koettlitz has taken advantage of the returning daylight to grow a crop of mustard and cress. He has raised some on flannel, and with chemicals, but the best result has been obtained from our own Antarctic soil, which is evidently most productive. The wardroom skylight does not make a very large garden, but enough cress has been produced for one good feed for all hands.'

'*October* 19.—The weather conditions have not been too favourable to our changes, though of course they have not delayed the return of full daylight, which has the most cheering effect. On the 12th commenced one of the thickest and longest blizzards we have yet had. Except for a calm interval of six hours on the 13th, the snow was whirling about us continually till midday on the 16th. The wind as usual commenced in the south and gradually worked round to the east, and the temperature rose at one time to +2°. This blizzard seems to have cleared the air for the time, as the weather since has been bright and clear, and we have had the most gorgeous light effects.

'On Saturday night between ten and eleven we witnessed an especially curious sight. The sun was behind Mount Discovery, and cast a clear shadow of its cone on a bank of cirro-stratus cloud on the near side. This effect was very curious; there appeared to be a clearly defined inverted cone superimposed on the top of the mountain.'

'*October* 20.—I think it may safely be said that our scurvy is at an end, and unless it is produced again in the sledge parties we shall hear no more of it. I do not think

the milder conditions of the future sledging season are likely to reproduce it, but so as to avoid the risk I have been arranging to replace the pemmican by a proportion of cooked seal-meat. The difficulty here is to get it free from water, and the only way is to cook it again and again, but with all our efforts I doubt whether we shall get quite the same value for weight as we do in the pemmican.'

It may be of interest here to quote the result of some of our experiments in this line, though, of course, they rest on estimation, as we had no facilities for chemical analysis.

We took 140 lbs. of seal-meat, and cooked it in 20 lbs. of margarine, producing as a result 60 lbs. of cooked meat; or, in other words, we evaporated off a little under two-thirds of the original weight. Raw meat contains about 75 per cent. of moisture, and we estimated our margarine to contain about 20 per cent.; so speaking very roughly, something under three-quarters of the original weight of our seal and margarine was water.

Again very roughly, therefore, in the cooked meat which remained there was water equal to about a twelfth of its original weight, or about a fourth of its present weight. We estimated that we eventually reduced this moisture to 20 per cent., and in this state we calculated that 12 lbs. of seal-meat was equal to 10 lbs. of pemmican.

'*October* 20 (*continued*).— . . . We have come to the end of our fresh mutton, except a small quantity kept for possible sickness; this makes a difference to Sunday, but our seal-meat is now so well served that the loss is not greatly felt. In this matter of seal-meat there has been an extraordinary change throughout the ship. There is no getting over the fact that none of us really enjoyed the seal in the winter, and when tinned meat was stopped there were not a few downcast faces; but within a fortnight all that has been altered: everyone now eats the seal with relish, and I do not think there is a single man

who would go back to tinned meat, even if he had the chance. The consumption is so great that we have all our work to keep up the supply, and appetites seem to be increasing rather than lessening. Somewhere in this, but not wholly revealed, lies the root of our scurvy trouble; one would fain be able to trace it more clearly.'

In the extracts which I have given from my diary it is possible to trace the history of our scurvy from its outbreak to the time when it vanished from amongst us, but they show also that we were in the unsatisfactory state of being unable to trace the cause of the evil, and in that state we still remain, for amongst the various circumstances of our daily life we can find none that definitely contributed to it. The surprise which this unpleasant discovery brought us has not been lessened by time. We are still unconscious of any element in our surroundings which might have fostered the disease, or of the neglect of any precaution which modern medical science suggests for its prevention.

It is well known that scurvy is a world-wide disease, and that, whilst it has attacked all sorts and conditions of men, it has proved an especial scourge to those who, by force of circumstances, have been deprived of fresh food for any length of time. This last has been so often the lot of the polar traveller that the disease has played a particularly important, and often a tragic, part in his enterprises, and one cannot read the history of polar adventure without realising the gravity of the evil and the urgency of precautionary measures. It was natural, therefore, that this subject should have been one of the first to be considered by one, like myself, on whom fell the responsibility of equipping an expedition for Antarctic research, and I felt at once that, however efficient might be the medical staff, it was highly desirable that I also should know something of it. Needless to say, I could

only approach the matter as a layman, and therefore it is only in that capacity that I offer the following remarks, though I had the advantage of excellent medical advice in forming my opinions.

The symptoms of scurvy do not necessarily occur in a regular order, but generally the first sign is an inflamed, swollen condition of the gums. The whitish pink tinge next the teeth is replaced by an angry red; as the disease gains ground the gums become more spongy and turn to a purplish colour, the teeth become loose and the gums sore. Spots appear on the legs, and pain is felt in old wounds and bruises; later, from a slight œdema, the legs, and then the arms, swell to a great size and become blackened behind the joints. After this the patient is soon incapacitated, and the last horrible stages of the disease set in, from which death is a merciful release. Curiously enough, I believe that the appetite is rarely lost even towards the end, and the rapidity with which the disease spreads is excelled by the rapidity of recovery if circumstances allow the proper remedies to be applied.

For centuries, and until quite recently, it was believed that the antidote to scurvy lay in vegetable acids; scurvy grass was sought by the older voyagers, and finally lime-juice was made, and remains, a legal necessity for ships travelling on the high seas. Behind this belief lies a vast amount of evidence, but a full consideration of this evidence is beset with immense difficulties. For instance, although it is an undoubted fact that with the introduction of lime-juice scurvy was largely diminished, yet it is apt to be forgotten that there were other causes which might have contributed to this result; for at the same time sea voyages were being largely reduced by steam power, and owners were forced to provide much better food for their men.

It is beyond the scope of these pages to deal with such

evidence, and it is sufficient to remark that modern medical thought finds it inconclusive, taking the view that the only antidote to scurvy is to banish its cause. Thus put, it is easy to see that many cures might have been attributed to the virtues of a supposed antidote which were really due to a discontinuance of the article of food that caused the disease.

I understand that scurvy is now believed to be ptomaine poisoning, caused by the virus of the bacterium of decay in meat, and, in plain language, as long as a man continues to assimilate this poison he is bound to get worse, and when he ceases to add to the quantity taken the system tends to throw it off, and the patient recovers. The practical point, therefore, is to obtain meat which does not contain this poison, and herein lies the whole difficulty of the case, for danger lurks everywhere. Tainted fresh meat may be virulent, but in the ordinary course of events one eats it rarely and so is saved from any disastrous result. The risk of a taint in tinned meat is greater because of the process involved in its manufacture, and with salt meat the risk is greater still for the same reason. To what extent meat must be tainted to produce scurvy is unknown, but there is reason to suppose that the taint can be so slight as to escape the notice of one's senses; in other words, poison may lurk in a tin of meat which to the sight, taste, and smell appears to be in perfect condition. Such a supposition alone shows the difficulty of tracing an outbreak of the disease to its exact source.

It is important to lay stress on the foregoing remarks because it is very commonly thought that unwholesome tinned meat can be detected at once by the proportion of tins that are 'blown.' Such a test must, of course, be a good rough guide as between good and bad, but it does not achieve the delicacy necessary to detect food which may cause scurvy. As having achieved an un-

surpassed feat in the prevention of scurvy, Dr. Nansen may well be taken as an authority in this matter; and more or less to this point he relates a story where a party of men found a depot of provisions, selected the best tins, ate of them, and got scurvy; his comment is that they would have done better to have selected the worst tins.

On the many points of importance with regard to the selection of tinned provisions I am not able to dwell—it is sufficient to show that the question is more complicated than appears at first sight; and, further, it must be remembered that there is no service where excellence is demanded so fully as on polar service. The ordinary traveller may be obliged to subsist on tinned food for weeks or months, but the polar voyager may be forced to extend these periods to months and years.

One great practical certainty arises, however, out of this complicated problem: one cannot be too careful; without being able to ensure perfection in one's tinned provisions, one can go a long way towards it by very careful selection and by preparing with all the safeguards which modern science can suggest. Such a preparation requires time, and therefore it becomes still more evident that ample time should be allowed for the equipment of a polar expedition.

With these few general remarks I would briefly trace the history of such circumstances as may have led to the outbreak of scurvy in the 'Discovery.' I commence by giving some account of the provisions which we carried. Owing to facts which can be well understood from the shortness of time at our disposal, it was not until the spring of 1901 that our provision list was finally drawn up and the necessary orders given; the orders were distributed over a large number of firms, and deliveries were directed to be made to the East India Docks, where a shed had been placed at our disposal. At the same time,

by the courtesy of the Health Office of the City of London, it was arranged that all the tinned food collected in the shed should be examined by one of their officials before it was transmitted to the 'Discovery.' The examination showed that, as far as could be seen, everything was of good quality with the exception of one delivery, and it became a question whether we should reject the whole of this delivery and seek a fresh contractor, or whether we should reject only the portion that was unsatisfactory and demand its renewal. Urgency decided in favour of the latter alternative. It must be understood that the food supplied after this rejection, and indeed all the food that actually sailed in the 'Discovery,' was examined, but such an examination has obvious limitations. The suspicious circumstance was that *anything* ordered for the 'Discovery' should have been unsatisfactory, and the inference was that if there were shortcomings in this delivery which the examination could detect, there would probably be others which it could not.

On our arrival in New Zealand we shipped a large addition to our stock of tinned food, some on a consignment from Australia, and some on purchase in the colony itself; both deliveries were excellent as far as we had any power of judging.

I have already given some idea of our routine in winter quarters with regard to meals. It will be recalled that we had seal-meat twice a week, mutton once, and tinned meat on the remaining days; the problem is, which of these gave us the scurvy?

As regards the seal-meat, I think we may at once reject the idea. The animals had to be skinned immediately after they were killed, and carcases were thus frozen within a very short space of time.

The mutton is more doubtful. It was killed inside the Antarctic circle, but I am not sure that the meat was wholly above suspicion of taint, as the sun may have

raised the darker portions of the carcases above the freezing-point; but it is to be remembered that though we ate very heartily of it, we only enjoyed this luxury once a week.

The grave suspicion naturally rests on the tinned meats, and therefore it becomes necessary to examine a little more closely into them. In nine cases out of ten our solid food on ordinary 'tinned meat' days consisted of plain tinned beef or mutton made up into some dish on board. It was the rarest thing for us to open tins containing made-up dishes, mainly because these were part of the consignment which I mentioned as being unsatisfactory. Without exception the plain beef and mutton came from Australian and New Zealand firms, and I have no doubt that it was as good as such things can be; the excellent state of preservation of that which we brought back is alone sufficient to prove this. I cannot think, therefore, that we have a right to suspect these tinned meats. In considering all facts in connection with this elusive disease, it must not be forgotten also that we regularly opened tins of milk and less regularly other 'kickshaws' in which it may have been hidden; but as we continued this practice during our second winter, without ill result, it is reasonable to consider that its effect may be discounted.

The main fact, however, that makes it so difficult to trace our scurvy to faulty provisions is that not a single tin of any sort or description was served out in the 'Discovery' until it had been opened and examined by one of the doctors, and in this respect no risks were taken. The least suspicion was sufficient to ensure rejection, and therefore it is certain that no food which bore any outward sign of being unsafe was ever consumed in the ship.

It has been pointed out that scurvy depends largely on environment, and there can be no doubt that severe

or insanitary conditions of life contribute to the ravages of the disease. Indeed, we saw how this might be from the outbreak in our western party, but I do not think such conditions can be regarded as the prime cause.

In summing up this brief survey of our outbreak of scurvy, I may point out that the evidence shows it was caused by the food the discontinuance of which led to recovery, and that this food consisted of tinned meats which were to all appearances of the best quality, and of apparently fresh mutton taken in small quantity. Beyond this it seems impossible to go, and consequently, as far as the investigation of the disease is concerned, we are left in an unsatisfactory position of doubt.

Our scurvy came to us as a great surprise. Fully alive to the danger of the disease, we seemed to have taken every precaution that the experience of others could suggest, and when the end of our long winter found everyone in apparently good health and high spirits, we naturally congratulated ourselves on the efficacy of our measures. How rudely we were awakened from this pleasing attitude I have shown, and, though the disease was banished with astonishing rapidity, the incident could not fail to leave an impression that in some manner we had been unwittingly culpable. Quite apart from the benefit lost to medical science, therefore, it was extremely grievous that, for our own personal satisfaction, we could not put our finger on the spot, and definitely state whence the evil sprang.

Yet, inconclusive as our experience was, it serves to emphasise the lessons taught by former experiences. It shows that too much care and attention cannot be paid to the provisioning of a polar expedition ; it indicates that in this connection the ordinary methods of food examination are not sufficiently refined, but should be supplemented by chemical analyses and every test that

modern science can suggest; and it again points clearly to the inestimable advantage of fresh food.

In this last respect there lies the most invaluable safeguard for the welfare of future Antarctic expeditions; it seems evident that the whole circle of the Antarctic seas is abundantly provided with animal life. It is not conceivable, therefore, that any party wintering in the Antarctic Regions will have great difficulty in providing themselves with fresh food; and, as we have proved, where such conditions exist there need be no fear of the dreaded word 'scurvy.'

END OF THE FIRST VOLUME

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